

***4100***  
***PRINTER***  

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***OPERATOR'S GUIDE***

Part No: 066-00428-02

Rev. F



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Output Technology Corporation  
2310 North Fancher Road  
Spokane, WA 99212-1381

USA

We suggest you use authorized service centers. Contact us at :

Voice: (509) 536-046 8 — Fax: (509) 533-1280

For service, please have your printer model and serial numbers handy—these are located on the back of the printer.

Output Technology maintains a Bulletin Board System (BBS) service. In the U.S.A., call (509) 533-1217 to access our BBS service for the very latest drivers, firmware, pricing, maintenance and troubleshooting aids, and application information. Also, you can contact us at :

FTP:            [ftp.output.com/public/output](ftp://ftp.output.com/public/output)

WWW:        <http://www.output.com>

## IMPORTANT SAFETY PRECAUTIONS



***DANGER:*** KEEP HAIR, HANDS, AND CLOTHING AWAY FROM MECHANISM, AND AVOID HOT SURFACES.

***VORSICHT:*** HAAR, HÄNDE UND KLEIDUNG VON DEM MECHANISMUS FERNHALTEN, UND HEISSE FLÄCHEN MEIDEN.

***DANGER:*** N'APPROCHER NI LES CHEVEUX, NI LES MAINS, NI LES VETEMENTS DU MECANISME, ET EVITER LES SURFACES CHAUDES.

***PERICOLO:*** TENERE CAPELLI, MANI ED INDUMENTI LONTANI DAL MECCANISMO, ED EVITARE SUPERFICI CALDE.

***PELIGRO:*** MANTENGA CABELLOS, MANOS Y VESTIMENTOS ALEJADOS DEL MECANISMO DE IMPRESION, Y EVITE SUPERFICIES CALIENTES.

- Opening or removing covers may expose you to dangerous voltage points or other risks. Servicing must be done by qualified personnel only. In the event of product damage, liquid spillage, or a distinct change in performance requiring service, unplug the printer from the wall outlet.
- Always plug the printer power cord into a three-wire grounded receptacle.

- DO NOT operate the printer unless its voltage is set to the local line voltage, as described in this manual.
- Keep printer vents free from obstructions.
- Keep the printer dry. If water is accidentally spilled on the printer, turn the power OFF immediately and wipe it dry. Do not turn the power on until the printer is completely dry.
- Do not lean or stack objects on or against the printer. If an object is accidentally dropped into the printer, turn OFF power and carefully remove the object.
- Use a high-quality, well-shielded interface cable. Both connectors should be metal and connected to chassis (frame) ground.
- Make sure the power is OFF anytime you are connecting or disconnecting the power cable or interface cable.
- Be sure the cover is secure while the printer is running.

## SUPPLIES AND SERVICES

**Important !** For best results and longest printer life, insist on genuine, factory-approved, ribbon cartridges. (Re-inked or remanufactured ribbon cartridges are not suitable.) Obtain factory-approved ribbon cartridges from your dealer or directly from the printer manufacturer:

Output Technology Corporation

2310 North Fancher Road — Spokane, WA 99212-1381

Voice: 1-800-468-8788 — Fax : (509) 533-1280

*Genuine, factory-approved ribbon cartridges are your best price-performance value.* Factory-approved ribbon cartridges are manufactured to close tolerances under exacting quality control to provide long life, reliability, and uniformity.

Order your ribbons *fast*. Tear out and use the handy fax form following Page viii.

If you need service, contact us for the name of the nearest certified service agent. Please have your printer model and serial numbers handy—these are located on the back of the printer. When you call, ask about our **Factory Express Service Program!**

## FCC COMPLIANCE STATEMENT

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Shielded cables and I/O cords must be used for this equipment to comply with the relevant FCC regulations.

Changes or modifications not expressly approved in writing by Output Technology Corporation may void the user's authority to operate this equipment.

## **EPA ENERGY STAR PRINTERS PARTNER**

The 4100 printer complies with voluntary standards for low-power consumption as set forth by the U.S. Environmental Protection Agency.

## **DOC COMPLIANCE STATEMENT**

This digital apparatus does not exceed the limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques prescrites dans le règlement sur le brouillage radioélectrique édicté par le Ministère des Communications du Canada.



## **CERTIFICATE OF MANUFACTURER/IMPORTER**

It is hereby certified that the 4100 Series printers have been suppressed in accordance with the conditions set out in the BMPT-AmtsbiVfg 243/1991 and 46/1992. The operation of some equipment (e.g. test transmitters) in accordance with the regulations may, however, be subject to certain restrictions. Please refer to the notes in the operating instructions.

The Federal Ministry for Telecommunications Approvals has been notified of the placing of this equipment on the market and has been granted the right to test the series for compliance with the regulations.

This equipment has been tested concerning compliance with the relevant RFI protection requirements both individually and on system level (to simulate normal operation conditions). However, it is possible that these RFI Requirements are not met under certain unfavorable conditions in other installations. It is the user who is responsible for compliance of his particular installation.

Compliance with applicable regulations depends on the use of shielded cables. It is the user who is responsible for procuring the appropriate cables.

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This product meets the requirements of the European Communities EMC Directive.

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## Glossary

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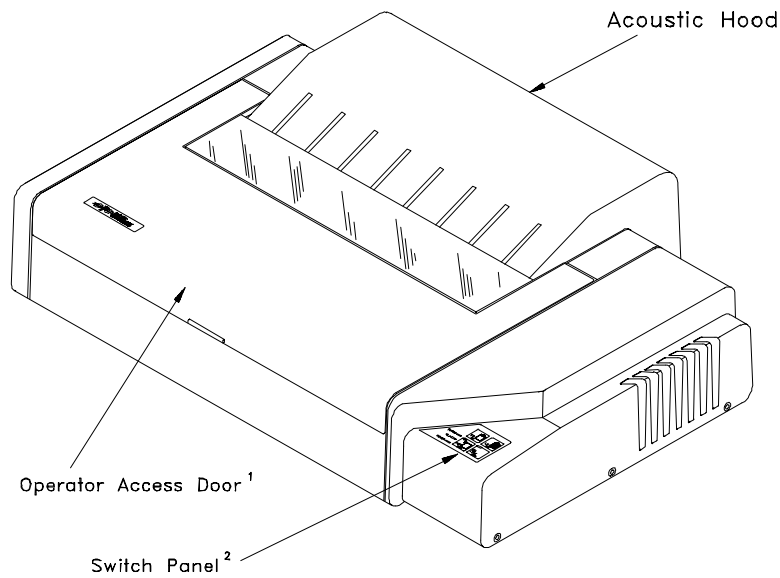


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# Basics

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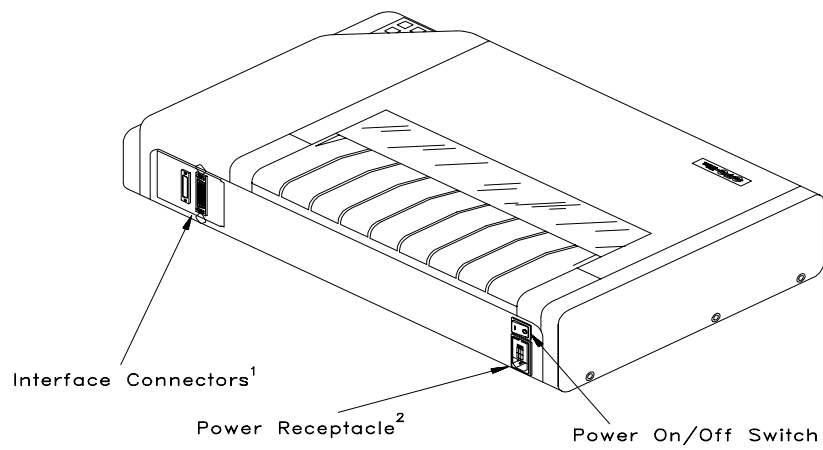
## BASIC PHYSICAL FEATURES



1. See "Operator Access," Page 3.
2. See "Switch Panel," Page 6.

The Printer (Front View, Shown With Acoustic Hood)

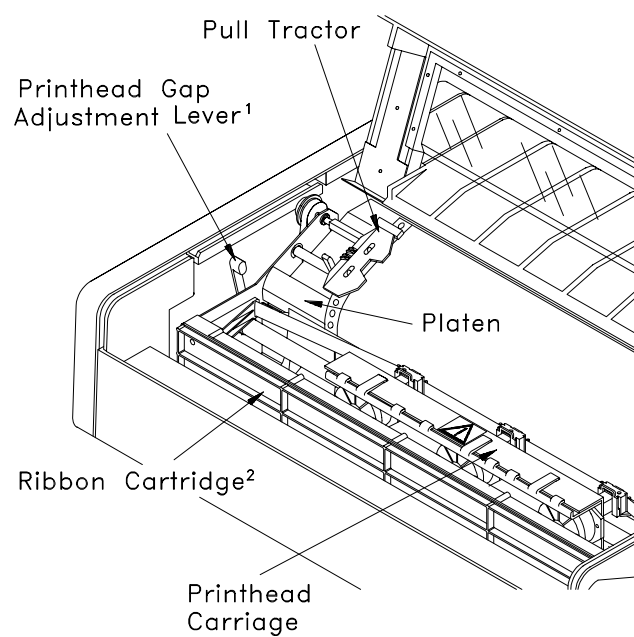
JB0-AB1



1. See "Interface Connectors," Page 16.
2. See "Power Receptacle," Page 15.

The Printer (Rear View, Shown Without Acoustic Hood) JB0-AC1





1. Use in adjusting printhead gap when loading paper. See "Loading Paper" and/or "Adjusting the Printhead Gap," Pages 21 and 27.
2. See "Changing Ribbon Cartridge," Page 99.

## BASIC STARTUP AND PRINTING

### **A** Check Paper Supply.

If necessary, load paper. See "Loading Paper," Page 21.

### **B** Close Operator Access Door.

### **C** Turn on printer.

Press the **I** side of the power on/off switch (Page 6).

### **D** Check Top of Form Setting.

Normally, set the horizontal perforation to be even with the "TOF" arrow ( **▶** ). If top of form must be reset, see "Setting Top of Form," Page 30.

**E****Check Print Quality.**

Make sure the **ON LINE** indicator is lit (Page 8) and the operator access door is closed, and then send a file from the host computer to the printer:

- If the print is too light or too dark (smudged), or if some dots are not being printed, adjust the printhead gap. (See "Adjusting the Printhead Gap," Page 27.) If necessary, replace an old ribbon cartridge with a new one (Page 99).
- If desired, switch between near letter quality (NLQ) and draft quality by pressing and holding **ON LINE** and then momentarily pressing **NLQ**. Although NLQ has more dots, and therefore looks better than draft quality print, draft is faster.

**F****Remove Printout.**

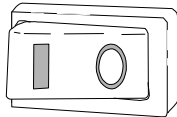
1. Press **ON LINE** to place printer off line.
2. Use **FORM FEED** to move paper to a convenient tear-off point.
3. Separate printout from paper supply at perforation.
4. Press **ON LINE** again to place printer on line.

## BASIC CONTROLS AND INDICATORS

### POWER ON/OFF SWITCH

This power on/off switch is located at the left-rear corner of the printer.

Press the **I** side of this switch to turn on the printer. Make sure the **O** side (the off side) is depressed when :



JB0-AU

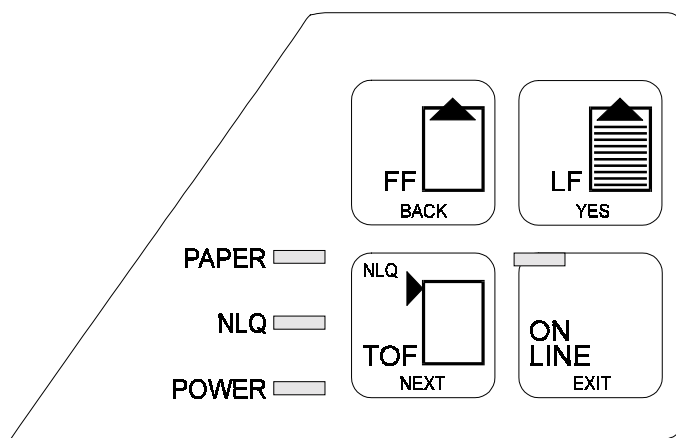
- Connecting or disconnecting cables
- Performing operations close to the printhead carriage

When you turn on the printer, it automatically performs a brief diagnostic test which lights indicators, moves the printhead carriage, and sounds the beeper. For more about this test, see "Power-Up Sequence Test," Page 131.

The power on/off switch is also used in conjunction with switch panel keys to perform various printer operations following the power-up sequence test. For information about these key combinations, see "Combination Keys," page 10.

## SWITCH PANEL

The switch panel is located at the right-front corner of the printer. The switch panel contains four indicator lights and four keypad switches.




JB0-BD


**PAPER** 

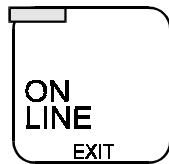
Paper Out (Fault) Indicator. Glows amber when the printer is out of paper.\* Flashes if an overcurrent, carriage motor problem, paper jam, or other fault occurs. (See "Paper Problems" in the troubleshooting chart, Page 124.)

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\* Except when in configuration menu mode.

**NLQ**  Near Letter Quality. Glows green to indicate near letter quality printing is selected. To quickly switch between draft quality and NLQ, press and hold **ON LINE** and then momentarily press **NLQ**.

**POWER**  Power On Indicator. Glows green to indicate the printer is receiving AC power.



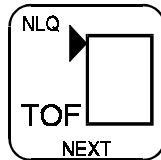
On Line/Exit Key and Indicator. Press once to place printer on line. The indicator glows green. Press again to place printer off line. Each time **ON LINE** is pressed, the beeper sounds:

When on line, printer can print data received from the computer.

When off line, you can set top of form, move paper, or change configuration.

Also, use this key to exit the configuration menu.

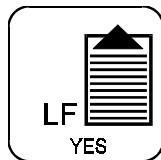
The **ON LINE** indicator flashes when the operator door is open.



Top Of Form / NLQ / NEXT Key. With printer off line, press to set top of form. (See "Setting Top of Form," Page 30). Printer beeps once when top of form is set.

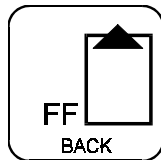
Press along with **ON LINE** to switch between near letter quality (NLQ) and draft modes.

Also, use this key to move through the configuration menu. (See "Navigating the Configuration Menu," Page 51.)



Line Feed / YES Key. With printer off line, press once to advance paper one line. Hold pressed to advance multiple lines. (Also used in micro-positioning the paper. See "On-Line Hot Keys," Page 12.)

Also, use this key to choose configuration menu options. (See "Navigating the Configuration Menu," Page 51.)



Form Feed / BACK Key. With printer off line, press once to eject a page, that is, to print anything still in the output line buffer (if applicable) and then to advance paper to the top of the next form. Hold pressed to move paper continuously. (Also used in micro-positioning the paper. See "On-Line Hot Keys," Page 12.)

Also, use this key to move through the configuration menu. (See "Navigating the Configuration Menu", Page 51.)

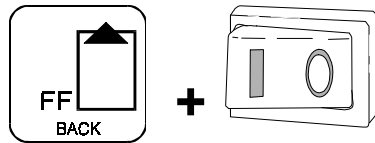
## COMBINATION KEYS

The power on/off switch and the **ON LINE** key are used in combination with other keys to perform various operations. Although most of these operations can be selected from the configuration menu, the "hot" keys are faster.

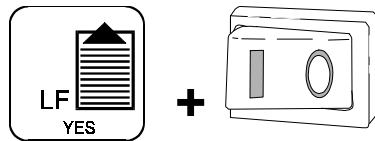
### Power-Up Hot Keys

The power-up hot keys allow you to power up the printer, perform a power-up sequence test, and then enter one of three menu or test modes, all in the same switch panel operation. For all power-up hot keys, you must press the switch panel key, hold that key depressed, and then turn on the printer. Hold down the switch panel key for a couple of seconds after turning on power.

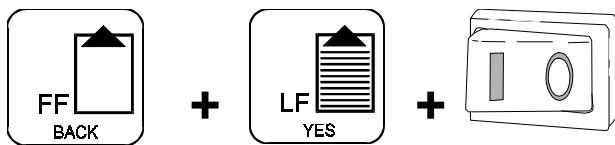




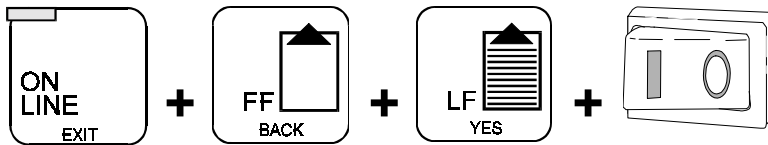
Configuration Menu. While pressing **FORM FEED**, turn on printer to print out the first configuration menu query. (See Configuration section, Page 49.)



Self Test. While pressing **LINE FEED**, turn on printer to begin a rolling printout of keyboard characters. (See "Running a Self Test," Page 29.) To stop printout, press **ON LINE** or turn off the printer.



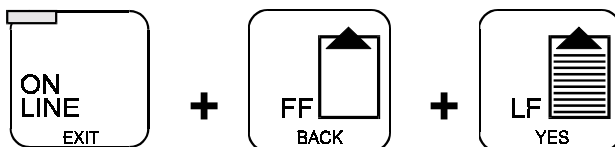
Hex Dump (Wide Form). While pressing **FORM FEED** and **LINE FEED**, turn on printer to place printer in 10 pitch hex dump mode. (See "Hex Dump Mode," Page 132.) To exit hex dump mode, turn off the printer.



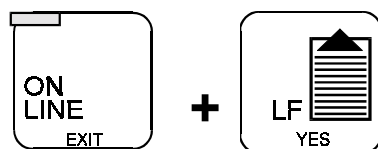
Hex Dump (Narrow Form). While pressing **ON LINE**, **FORM FEED**, and **LINE FEED**, turn on printer to place printer in 17.14 pitch hex dump mode. (See "Hex Dump Mode," Page 132.) To exit hex dump mode, turn off the printer.

## On-Line Hot Keys

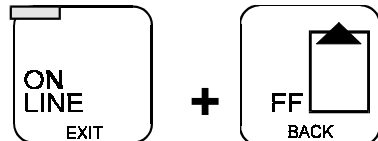
The on-line hot keys allow you to enter the configuration menu (without having to turn off the printer), to fine position the paper, and to switch print quality modes. For all on-line hot keys, you must press the **ON LINE** key, hold that key depressed, and then momentarily press the indicated switch panel key(s).



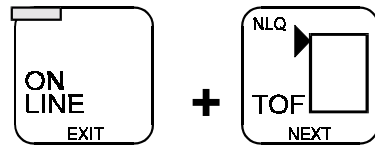
Configuration Menu. While pressing **ON LINE**, momentarily press **FORM FEED** and **LINE FEED** at the same time to print out the first configuration menu query. (See Configuration section, Page 49.)



Move Up Paper/Speed Exit. While pressing **ON LINE**, momentarily press **LINE FEED** to advance paper by one microline ( $1/144$  in.). Use this for fine positioning the paper when setting top of form. (See "Setting Top of Form," Page 30.) Also used for fast exiting the configuration menu.



Move Down Paper. While pressing **ON LINE**, momentarily press **FORM FEED** to back up paper by one microline ( $1/144$  in.). Use this for fine positioning the paper when setting top of form. (See "Setting Top of Form," Page 30.) When backing up paper, pull down slightly on the paper.

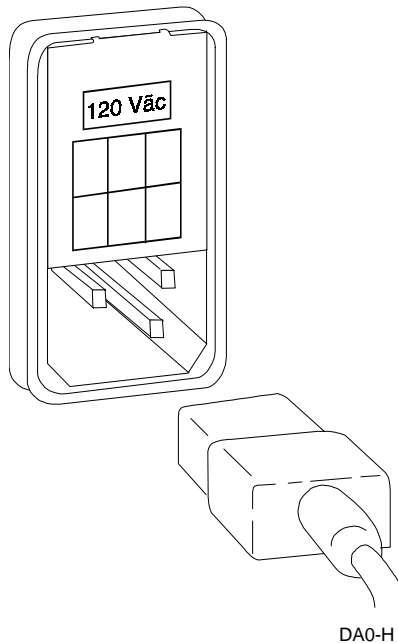


Near Letter Quality. While pressing **ON LINE**, momentarily press **NLQ** to switch between near letter quality and draft quality printing modes.

## BASIC CONNECTIONS

### POWER RECEPTACLE

The power receptacle is located at the left-rear corner of the printer, below the power on/off switch.

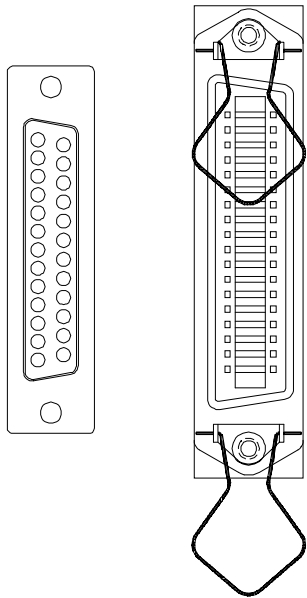


One end of the power cord plugs into the lower portion of the receptacle. The other end of the power cord plugs into a standard three-prong, grounded electrical outlet. Plug power cord only into the type of power source specified in the window near the top of the receptacle. The window shows either 120 V~c, 100 V~c, 220 V~c, or 240 V~c.

The compartment above the power cord contains a voltage selection tumbler and two fuses. If necessary, to change the voltage selection or the fuses, refer to "Changing Fuses," Page 107.

## INTERFACE CONNECTORS

### Serial Parallel



JB0-AA1

Serial and parallel interface connectors are located near the right-rear corner of the printer. Use one of these connectors to interconnect the printer and host computer.

Always turn the printer off when disconnecting or connecting a cable connector, always use a shielded cable, and always lock the cable connector to the printer connector, as specified in the following paragraphs.

### Parallel Interface

The parallel interface connector is a standard Centronics-type connector with 36 pins. The triangular clips on the top and bottom of the connector are used to lock in the cable connector.

For more information on parallel connectivity, see Appendix C.

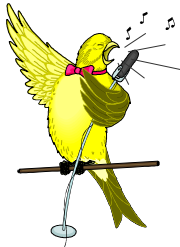
## Serial Interface

The serial interface connector is a standard RS-232, 25-pin, D-type connector. Normally, thumbscrews attached to the cable connector are used to lock the cable connector to the printer connector.

For more information on serial connectivity, see Appendix B.

## BASIC BEEPS!

The beeper sounds to confirm a change or to flag an error or failure. For errors and failures, see "Beeps" (Page 119) in the troubleshooting chart.



One chirp is heard when :

- Power-up sequence test is successful.
- **ON LINE** is pressed.



One short beep is heard when the top of form is set.



Three sets of low-high beeps are heard when a paper jam occurs.



Four-second solid beep is heard when:

- Paper runs out\*
- Left tractor is too far right
- Paper out sensor fails



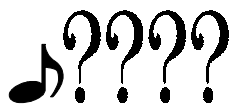
Intermittent single beeps are heard when a string of bad data is received on serial interface.\*\*

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\* Except when in configuration menu mode.

\*\* Turn off printer to stop beeping.





One short beep followed by four short-long beeps indicates the printer has encountered a recoverable memory error.<sup>†</sup>



Five long beeps are heard when the printer encounters a nonrecoverable error.<sup>††</sup>

---

<sup>†</sup> If problem persists, record beep pattern and then see BEEPs in Troubleshooting Chart (Page 119).

<sup>††</sup> Turn off printer and then turn back on. If problem persists, record beep pattern. Press **ON LINE** several times to solicit additional beep patterns, if any, then see BEEPs in Troubleshooting Chart (Page 119).



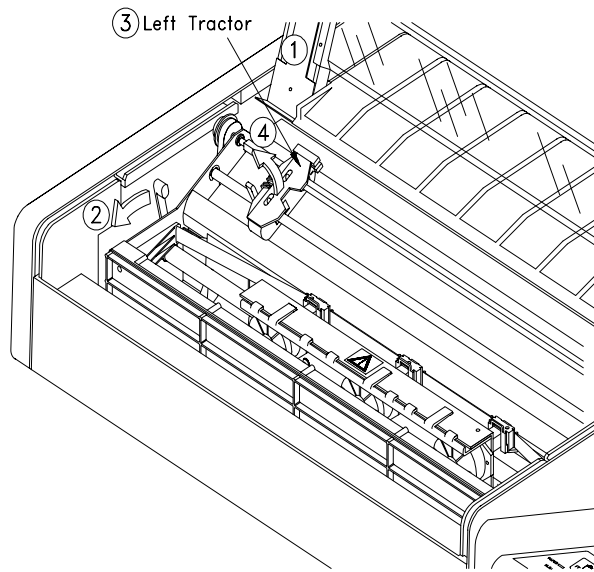
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# Operations

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## COMMON OPERATIONS

### LOADING PAPER:

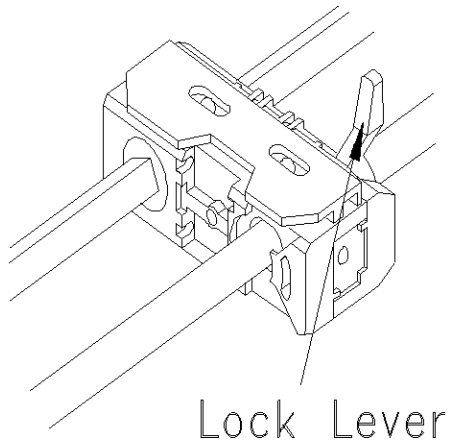


Loading Paper

JB0-AF1

To load paper, follow these steps:

1. Open operator access door.
2. If you plan on loading the same type of paper, note the setting of the printhead gap adjustment lever and then move printhead gap adjustment lever toward you (away from paper), as far as possible.



3. If necessary, reposition tractors to accommodate a change in paper width, as follows:

- a. Keep the left tractor locked at the extreme left end of its travel.
- b. Lift lock lever on right tractor.
- c. Slide right tractor along its shafts and position it, in relationship to the left tractor, to approximately match the width of the paper.
- d. For now, leave the right tractor unlocked.

Right Tractor JBO-N

*Note:* The paper out sensor is located near the left edge of the paper path below the platen. Normally, to prevent a false paper out alarm, keep the left tractor at the extreme left end of the platen. Move only the right tractor to accommodate changes in paper width.

4. Open hinged paper retainers on tractors.

### Paper Specifications\*

- **Type:** standard fanfold, edge perforated. Single-part to 6-part paper.
- **Sheet Width:** 3 in. to 16 in. (approx. 76.2 mm to 406.4 mm), including tractor strips.
- **Form Length:** 0.5 to 31.5 in. (approx. 12.7 to 800 mm) in  $\frac{1}{2}$  in. increments to conform to configuration menu setting.\*\*
- **Tractor Strips:**  $4.00 \pm 0.25$  mm dia. sprocket holes,  $\frac{1}{4}$  in. from outside edge of paper, located every  $\frac{1}{2}$  in. vertically.
- **Bond Weight:** 14 lb to 28 lb ( $52 \text{ g/m}^2$  to  $105 \text{ g/m}^2$ ) for single-part paper. Variable for multi-part paper\*.
- **Thickness:** 0.002 in. to 0.005 in. (approx. 0.065 mm to 0.13 mm) for single-part paper. Total thickness for multi-part paper is 0.018 in. (approx. 0.46 mm).

\* For more information, see Appendix A.

\*\* Other form lengths are available using emulation control commands. DEC emulation includes a No Form mode.

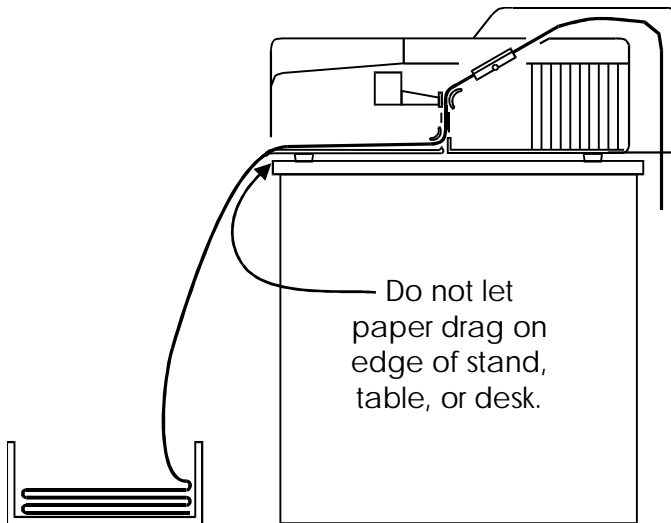
5. Feed paper from either the bottom or front of the printer, as shown in the following illustrations. Gently push paper up until it appears between printheads and platen.

*Note:* Prefer feeding paper stock from the bottom rather than the front. Feeding from the bottom is the most direct and trouble-free path, causing less stress on the paper's sprocket holes during high-speed printing. If you use multi-part paper or label stock, you should feed only from the bottom.

If you feed from the front, be sure paper flows freely into front entrance of printer\*\*\*.

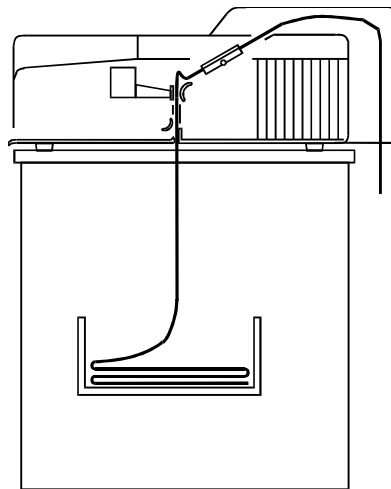
Prevent the paper from contacting the front of the printer stand (or table or desk edges, if not using the stand). Any excessive load or friction on in-feed paper will result in paper-handling problems.

\*\*\* The printer is shipped with a stand that allows paper to be fed from the bottom. If you intend to feed paper from the front, you must first remove a 16-in. foam plug from the front feed guide.



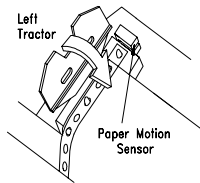
Front Feed

JB0-AG2



Bottom Feed

JB0-AH1



Left Tractor

JB0-L1

6. Align paper on tractor sprockets. Make sure that the paper is straight.
7. Adjust the position of the right tractor so that the paper is neither stressed nor buckled.

The sprocket pins should sit comfortably in the middle of the paper's sprocket holes. Paper holes should not be distorted.

8. Close retainers.
9. Make sure both tractors are locked in position.
10. Adjust the printhead gap:
  - If you reloaded the printer with the same type of paper, simply return the printhead gap adjustment lever to its previous position.
  - If you reloaded with a different thickness or weight of paper, see "Adjusting the Printhead Gap," Page 27.
11. Set top of form. (See "Setting Top of Form," Page 30.)

## ADJUSTING THE PRINTHEAD GAP

**Warning!** Make sure no article of clothing (necktie, jewelry) is hanging into the operator access during this procedure.

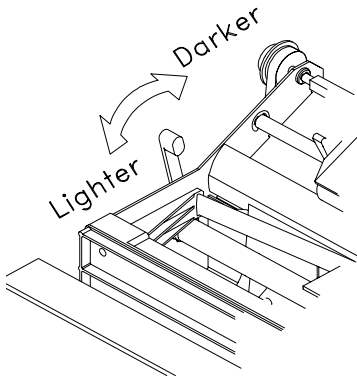
1. Open the operator access door.
2. Make sure the printhead gap adjustment lever is positioned as far as possible toward the front of the printer so that the gap between the printheads and platen is as wide as possible.
3. Turn on the printer.
4. Begin a printout by:
  - Sending a file (about three pages of characters) to the printer
  - Running a self test (See "Running a Self Test," Page 29.)
5. See the Note below and then move the printhead gap adjustment lever toward the platen.

The printout appears.

*Note:* The printhead gap must be set at normal print speed.

As a safety feature, when using "fast pitch" (10 pitch printing), the printer prints at half speed if the operator access door is open. To temporarily cancel half-speed printing during printhead gap adjustment, press and hold **TOF** while the printer prints.





Printhead Gap  
Adjustment Lever  
JB0-AJ1

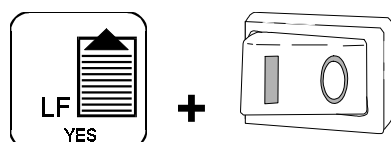
Adjust the printhead gap adjustment lever for desired print quality.

*Note:* The ideal setting of the printhead gap adjustment lever for longest ribbon and printhead life is just before printed dots begin to disappear. For multipart paper, check the bottom copy.

**Caution:** Do not use the printhead gap adjustment lever to compensate for light print as the ribbon cartridge begins to run out of ink. Narrowing the gap between the platen and printheads may cause excessive wear on the printheads and cause drag on the printhead carriage motor, in effect shortening their life span.

## RUNNING A SELF TEST

**Warning!** If you run self test with the operator access door open, make sure no article of clothing (necktie, jewelry) is hanging into the operator access.



While pressing **LINE FEED**, turn on printer to begin a rolling printout of keyboard characters. To stop printout, press **ON LINE** or turn off the printer.

**Note:** As a safety feature, when using “fast pitch” (10 pitch printing), the printer prints at half speed if the operator access door is open. To temporarily cancel half-speed printing during a self test, press and hold **TOF** while the printer prints.

!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/	0	1	2	3
"	#	\$	%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4
"	#	\$	%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4
#	\$	%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4	5
#	\$	%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4	5
\$	%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4	5	6
\$	%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4	5	6
%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4	5	6	7
%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4	5	6	7
&	'	(	)	*	+	,	-	.	/	0	1	2	3	4	5	6	7	8





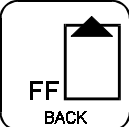
Self Test Printout

JB0-AI

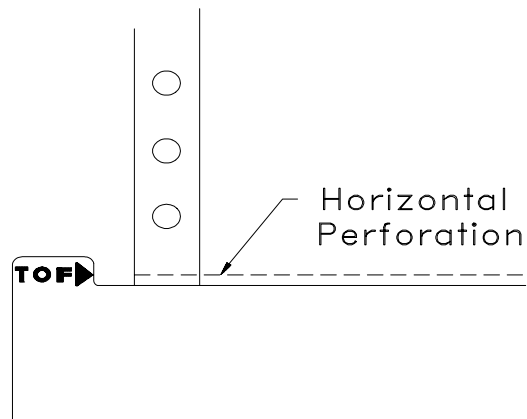
# SETTING TOP OF FORM

*Note:* The configuration menu option for form length must be set correctly before setting the top of form. (The factory default form length is 11 in.: usually set to correspond to 11 in. between horizontal perforations.) If necessary, see "Form Length," Page 77 in the Configuration section, to select a different length.

1. Use the paper positioning keys to move the paper to the desired top of form position.

Paper Position Keys	Paper Movement
<div>With</div> <div>Printer</div> <div>Off Line</div> <div>  </div>	Up 1 Line
<div>  </div> <div>+</div> <div>  </div>	Up by 1/144 in.
<div>  </div> <div>+</div> <div>  </div>	Down by 1/144 in.

Normally, the horizontal perforation is chosen as the top of form. For this, move the paper so that the horizontal perforation is even with the "TOF" arrow ( ► ) near the right and left edges of the platen.



Locating Top Of Form

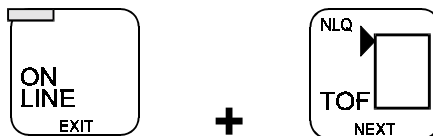
JB0-AK1

2. With the printer off line, press **TOF**.

The beeper sounds to confirm your new top-of-form setting.

## SWITCHING NLQ AND DRAFT

You can switch back-and-forth between near letter quality (NLQ) and draft quality print modes by pressing and holding **ON LINE** and then momentarily pressing **NLQ**:



In NLQ mode, the NLQ indicator lights. After switching modes you must press **ON LINE** to place printer on line.

You can also preselect a startup print mode in the configuration menu. This assures that the preferred print mode is automatically set after you turn on the printer. Draft print mode is the factory default startup print mode. If desired, see "Near Letter Quality," Page 72, in the Configuration section to change the startup print mode.

Once the printer is on, you can switch freely between NLQ and draft print modes using either the hot key explained above or, more commonly, by using a printer driver that matches your printer's present emulation. (See "Emulations and Printer Drivers" that follows.)

### **Emulations and Printer Drivers**

When a printer acts like another printer, it is said to emulate that printer. Your printer can emulate an Epson FX-100, IBM Proprinter XL, or DEC LA210 printer.

You can switch between emulations, as detailed in "Changing Emulations" that follows.

When you use a specific computer application (MS Windows, WordPerfect, Lotus 1-2-3, etc.) to print on a specific printer (Epson FX-100, IBM Proprinter XL, etc.) you must select a specific printer driver. The application's printer driver not only allows you to print on that printer, it also allows you to select such things as print quality (NLQ, draft), normal vs bold print, characters per inch, character sets, and others features and options available with the emulated printer. These printer driver selections override the configuration menu default selections.

**Remember:** If you change the emulation of your printer, you must change the selected printer driver in your computer application. Consult the manuals provided with your application.

## CHANGING EMULATIONS

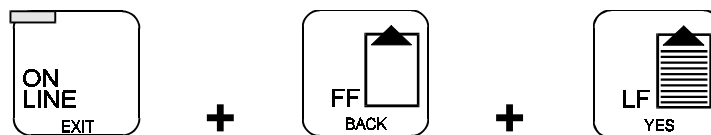
The factory default startup emulation is **Epson FX-100**, which means that the printer acts like an Epson FX-100 printer after you turn on the power. You can change the default startup emulation using the configuration menu. The other two emulation selections are **IBM Proprinter XL** and **DEC LA210**.

To change emulations, use a power-up or on-line hot key to enter the configuration menu:

1. Either press **FORM FEED** and then turn on the printer;



or, with the printer already on, press and hold **ON LINE** and then simultaneously press **FORM FEED** and **LINE FEED**.



The printer prints out:

HELP OPTIONS

2. Respond by pressing **NEXT**.

The printer prints out:

INTERFACE OPTIONS

•

3. Again, press **NEXT**.
4. Continue pressing **NEXT**



until the printer prints:

EMULATION

5. Then, press **YES**.

The printer prints out:

= Epson FX 100 ?

6. If you intend to change emulations, press **NEXT**.

The printer prints out:

change to IBM Proprinter XL ?

7. Press **YES** to select this emulation or **NEXT** to move on to "change to DEC LA210?"

Pressing **YES** to a selection records that selection.

8. Press **ON LINE** twice to exit the menu and to place printer on line.

The printer is now in the newly selected emulation and subsequently powers up in that emulation.



## PRINTING THE ACTIVE CHARACTER SET

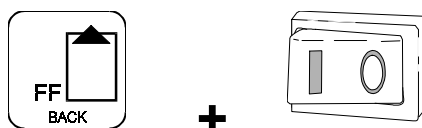
The configuration menu provides a way to print out the active character set.

For this feature, the active character set is defined as the menu-selected default character set along with any active overlays (OCR A, OCR B, download characters). Character sets selected by software applications such as word processing software cannot be printed using this help feature.

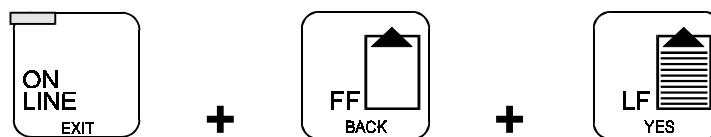
*Note:* The printout can be in either draft quality or NLQ mode and in either normal or italic style, depending on the present print quality and italics settings.

To print out a copy of the active character set use a power-up or on-line hot key to enter the configuration menu:

1. Either press **FORM FEED** and then turn on the printer;



or, with the printer already on, press and hold **ON LINE** and then simultaneously press **FORM FEED** and **LINE FEED**.



The printer prints out:

# HELP OPTIONS

2. Respond by pressing **YES**.

The printer prints out:

Status Print ?

3. Press **NEXT**.

The printer prints out:

Menu Tree ?

4. Again, press **NEXT**.

•

•

5. Continue pressing **NEXT**

•

•

•

until the printer prints :

•

Print Active Character Set ?

6. Then, press **YES**.

The printer moves to the top of the next form and then prints the active character set.

The illustrations on the following pages show the draft mode factory-default character sets for the Epson FX-100, IBM Proprinter XL, and DEC LA210 emulations. (Examples are shown smaller than actual size.) In these printouts, the first hexadecimal digit of the character or control code is written along the top of the table, and the second hexadecimal digit is written along the side. Thus, the hexadecimal control code for a capital

"Z" in all three character sets is 5A which is equivalent to decimal 90, using the hexadecimal-to-decimal conversion chart on Page 43.

## Active Character Set

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	NUL		0	@	P	`	p	NUL	NUL		0	@	P	`	p
1	SOH	DC1	!	1	A	Q	a	q	SOH	DC1	/	1	A	Q	a	q
2	NUL	DC2	"	2	B	R	b	r	NUL	DC2	"	2	B	R	b	r
3	NUL	DC3	#	3	C	S	c	s	NUL	DC3	#	3	C	S	c	s
4	NUL	DC4	\$	4	D	T	d	t	NUL	DC4	\$	4	D	T	d	t
5	NUL	NUL	%	5	E	U	e	u	NUL	NUL	%	5	E	U	e	u
6	NUL	NUL	&	6	F	V	f	v	NUL	NUL	&	6	F	V	f	v
7	BEL	NUL	'	7	G	W	g	w	BEL	NUL	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x	BS	CAN	(	8	H	X	h	x
9	HT	NUL	)	9	I	Y	i	y	HT	NUL	)	9	I	Y	i	y
A	LF	NUL	*	:	J	Z	j	z	LF	NUL	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{	VT	ESC	+	;	K	[	k	{
C	FF	NUL	,	<	L	\	l		FF	NUL	,	<	L	\	l	
D	CR	NUL	-	=	M	]	m	}	CR	NUL	-	=	M	]	m	}
E	SO	NUL	.	>	N	^	n	~	SO	NUL	.	>	N	^	n	~
F	SI	NUL	/	?	O	_	o	DEL	SI	NUL	/	?	O	_	o	DEL

JB0-AM

Printout of Epson U.S. Character Set  
(Factory Default for Epson Emulation)

## Active Character Set

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	NUL		Ø	@	P	`	p	NUL	NUL	á	≡	£	¤	α	≡
1	SOH	DC1	!	1	A	Q	a	q	SOH	DC1	í	≡	±	⌥	β	±
2	NUL	DC2	"	2	B	R	b	r	NUL	DC2	ó	≡	⌥	⌥	Γ	≥
3	NUL	DC3	#	3	C	S	c	s	NUL	DC3	ú		⌥	⌥	π	≤
4	NUL	DC4	\$	4	D	T	d	t	NUL	DC4	ñ	⌥	—	⌥	Σ	⌥
5	NUL	NUL	%	5	E	U	e	u	NUL	NUL	ñ	⌥	⌥	⌥	σ	⌥
6	NUL	NUL	&	6	F	V	f	v	NUL	NUL	æ	⌥	⌥	⌥	μ	÷
7	BEL	NUL	'	7	G	W	g	w	BEL	NUL	ø	⌥	⌥	⌥	τ	≈
8	BS	CAN	(	8	H	X	h	x	BS	CAN	¿	⌥	⌥	⌥	Σ	°
9	HT	NUL	)	9	I	Y	i	y	HT	NUL	⌥	⌥	⌥	⌥	Θ	•
A	LF	NUL	*	:	J	Z	j	z	LF	NUL	⌥	⌥	⌥	⌥	Ω	-
B	VT	ESC	+	;	K	[	k	[	VT	ESC	½	⌥	⌥	⌥	δ	⌥
C	FF	NUL	,	<	L	\	l	l	FF	NUL	¼	⌥	⌥	⌥	ω	⌥
D	CR	NUL	-	=	M	]	m	]	CR	NUL	⌥	⌥	⌥	⌥	ø	2
E	SO	NUL	.	>	N	^	n	~	SO	NUL	«	⌥	⌥	⌥	€	⌥
F	SI	NUL	/	?	O	_	o	NUL	SI	NUL	»	⌥	⌥	⌥	∩	

JB0-AN

Printout of IBM #1 U.S. Character Set  
(Factory Default for IBM Emulation)





























## Active Character Set

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	NUL		Ø	@	P	`	p	NUL	DCS		°	À		à	
1	SOH	DC1	!	1	A	Q	a	q	NUL	NUL	i	±	Á	Ñ	á	ñ
2	NUL	DC2	"	2	B	R	b	r	NUL	NUL	ç	²	Â	Ò	â	ò
3	NUL	DC3	#	3	C	S	c	s	NUL	NUL	£	³	Ã	Ó	ã	ó
4	NUL	NUL	\$	4	D	T	d	t	IND	NUL			Ä	Ö	ä	ö
5	ENQ	NUL	%	5	E	U	e	u	NEL	NUL	¥	µ	Å	Ø	å	ø
6	NUL	NUL	&	6	F	V	f	v	NUL	NUL		¶	Æ	Ö	æ	ö
7	BEL	NUL	'	7	G	W	g	w	NUL	NUL	§	·	Ç	Ø	ç	œ
8	BS	CAN	(	8	H	X	h	x	HTS	NUL	¸		È	Ø	è	ø
9	HT	NUL	)	9	I	Y	i	y	NUL	NUL	@	¹	É	Ù	é	ù
A	LF	NUL	*	:	J	Z	j	z	VTS	NUL		º	Ê	Ú	ê	û
B	VT	ESC	+	;	K	[	k	{	PLD	CSI	«	»	Ë	Û	ë	ü
C	FF	NUL	,	<	L	\	l		NUL	ST		¼	Ì	Ü	ì	ü
D	CR	NUL	-	=	M	]	m	}	NUL	NUL		½	Í	Ý	í	ý
E	SO	NUL	.	>	N	^	n	~	SS2	NUL			Î		î	
F	SI	NUL	/	?	O	_	o	DEL	SS3	NUL		¿	Ï	ß	ï	

JB0-AO

Printout of DEC U.S./Multilingual Character Set  
(Factory Default for DEC Emulation)

### Hexadecimal-To-Decimal Conversion (Along with U.S. PC-8 computer terminal characters.)

	0-	1-	2-	3-	4-	5-	6-	7-
0	<b>NUL</b> 0	 16	<b>SP</b> 32	<b>0</b> 48	<b>@</b> 64	<b>P</b> 80	<b>`</b> 96	<b>p</b> 112
-1	<b>•</b> 1	 17	<b>!</b> 33	<b>1</b> 49	<b>A</b> 65	<b>Q</b> 81	<b>a</b> 97	<b>q</b> 113
-2	<b>•</b> 2	 18	<b>"</b> 34	<b>2</b> 50	<b>B</b> 66	<b>R</b> 82	<b>b</b> 98	<b>r</b> 114
-3	 3	<b>!!</b> 19	<b>#</b> 35	<b>3</b> 51	<b>C</b> 67	<b>S</b> 83	<b>c</b> 99	<b>s</b> 115
-4	 4	 20	<b>\$</b> 36	<b>4</b> 52	<b>D</b> 68	<b>T</b> 84	<b>d</b> 100	<b>t</b> 116
-5	 5	 21	<b>%</b> 37	<b>5</b> 53	<b>E</b> 69	<b>U</b> 85	<b>e</b> 101	<b>u</b> 117
-6	 6	<b>•</b> 22	<b>&amp;</b> 38	<b>6</b> 54	<b>F</b> 70	<b>V</b> 86	<b>f</b> 102	<b>v</b> 118
-7	 7	 23	<b>'</b> 39	<b>7</b> 55	<b>G</b> 71	<b>W</b> 87	<b>g</b> 103	<b>w</b> 119
-8	 8	 24	<b>(</b> 40	<b>8</b> 56	<b>H</b> 72	<b>X</b> 88	<b>h</b> 104	<b>x</b> 120
-9	 9	 25	<b>)</b> 41	<b>9</b> 57	<b>I</b> 73	<b>Y</b> 89	<b>i</b> 105	<b>y</b> 121
-A	 10	 26	<b>*</b> 42	<b>:</b> 58	<b>J</b> 74	<b>Z</b> 90	<b>j</b> 106	<b>z</b> 122
-B	 11	 27	<b>+</b> 43	<b>;</b> 59	<b>K</b> 75	<b>[</b> 91	<b>k</b> 107	<b>{</b> 123
-C	 12	 28	<b>,</b> 44	<b>&lt;</b> 60	<b>L</b> 76	<b>\</b> 92	<b>l</b> 108	<b>;</b> 124
-D	 13	 29	<b>-</b> 45	<b>=</b> 61	<b>M</b> 77	<b>]</b> 93	<b>m</b> 109	<b>}</b> 125
-E	 14	 30	<b>.</b> 46	<b>&gt;</b> 62	<b>N</b> 78	<b>^</b> 94	<b>n</b> 110	<b>~</b> 126
-F	 15	 31	<b>/</b> 47	<b>?</b> 63	<b>O</b> 79	<b>_</b> 95	<b>o</b> 111	 127

## Hexadecimal-To-Decimal Conversion, continued

8-	9-	A-	B-	C-	D-	E-	F-	
Ç 128	É 144	á 160	• 176	• 192	ö 208	• 224	• 240	0
ü 129	æ 145	í 161	• 177	• 193	Đ 209	ß 225	± 241	-1
é 130	Æ 146	ó 162	• 178	• 194	Ě 210	• 226	• 242	-2
â 131	ô 147	ú 163	• 179	• 195	Ě 211	• 227	• 243	-3
ă 132	ö 148	ñ 164	• 180	• 196	Ě 212	• 228	• 244	-4
à 133	ò 149	Ñ 165	Á 181	• 197	¹ 213	• 229	• 245	-5
á 134	û 150	ª 166	Â 182	ã 198	Í 214	µ 230	÷ 246	-6
ç 135	ù 151	º 167	Ã 183	Ä 199	Î 215	• 231	• 247	-7
ê 136	ÿ 152	¿ 168	© 184	• 200	Ï 216	• 232	° 248	-8
ë 137	Ö 153	® 169	• 185	• 201	• 217	• 233	• 249	-9
è 138	Ü 154	ª 170	• 186	• 202	• 218	• 234	• 250	-A
ï 139	ø 155	½ 171	• 187	• 203	• 219	• 235	• 251	-B
î 140	£ 156	¼ 172	• 188	• 204	• 220	• 236	• 252	-C
ì 141	¥ 157	¡ 173	¢ 189	• 205	¡ 221	Ø 237	² 253	-D
Ä 142	× 158	« 174	¥ 190	• 206	¡ 222	• 238	• 254	-E
Å 143	f 159	» 175	• 191	¤ 207	• 223	• 239	SP 255	-F

### **What Is a Character Set?**

A character set consists of up to 256 printable patterns and printer instructions assigned to 256 possible codes. The character set tells the printer what to do or what to print when each of these codes is received from the computer.

The codes can be assigned to keyboard characters (0-9, a-z, A-Z, #, \*, etc.) foreign characters (such as Ë, æ, Ç), linedraw features (such as •••••), and symbols (such as ©, †, µ,™, barcodes). In addition, codes can be assigned for sounding the beeper, feeding a form, causing a horizontal tab, and so on. Literally, there are thousands of character and control possibilities, but only 256 can be assigned at any one time.

Either you or your application software chooses the active character set. But, the choice is primarily made by the application software. For example, if you draw a box around text, your MS Word application automatically chooses a linedraw character set, or, if you select the Swedish language in MS Windows, some of the keys on your keyboard cause Swedish characters to be printed.

You can assign a default character set for each printer emulation in the configuration menu. (See "Character Option," Page 81.) The preselected character set is automatically set as the active character set after you switch emulations. But, like most configuration default settings, your application software can change the active character set.

Appendix D shows all of the control code and character maps for all of the built-in emulations.



---

# Configuration

---

This section provides details on using the printer's configuration menu. Among other things, the configuration menu contains the printer's changeable configuration settings.

A new printer is preset at the factory to:

- Emulate an Epson FX-100 printer on a parallel interface, and
- Print 6 lines per inch of 10 pitch (10 characters per inch) draft quality characters on a form length of 11 in.

These factory settings specify how the printer reacts to data when you turn on the printer for the very first time. These constitute the factory default settings, or simply the factory defaults.

You can customize the defaults so that when you turn on the printer, it reacts differently. You might, for example, wish to change the default for "Lines/Inch" so that the printer prints 8 lines per inch instead of 6.

In the paragraph above, it is important to stress the phrase "...when you turn on the printer." In most cases, the host computer sends commands to the printer at the beginning of each print job to alter or completely override the defaults. Your defaults, whether factory defaults or customized defaults, only apply when you start up the printer and continuously print unformatted text files containing "straight ASCII" data.

Formatted data files, such as what MS-Windows, or WordPerfect, or Lotus 1-2-3, or another modern software application would send to the printer, contains control commands\* imbedded with the text to change many of the configuration settings to something other than the factory or customized defaults. Typically, a formatted data file contains codes to select bold versus normal type, near letter quality versus draft quality, pitch, character set, and on and on. In other words, the software application changes the printer's settings for the present print job. It does not change the defaults, because the next time the printer is turned on, the factory or customized defaults are reset.

The computer's software application can and does change most optional settings, but not all. For example, the software application does not change the parallel versus serial port settings, and it does not change from the Epson FX-100 emulation to, for example, the IBM Proprinter XL emulation. Choosing the right options for these types of setting—the ones that software applications do not change—is the main focus of the configuration menu.

If your printer's present performance is satisfactory, then the configuration is likely set correctly for your needs and no changes to the configuration are necessary. However, if the printer's performance requires alteration or improvement, then adjustment of the configuration may be appropriate.

The following is an explanation of the navigation of the configuration menu, where the default settings can be found and, when necessary, changed.

---

\* Control commands are covered in other sections of this manual.

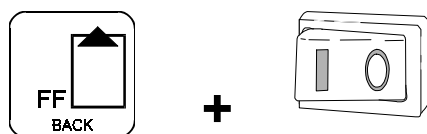
## THE CONFIGURATION MENU

The configuration menu consists of 42 changeable default settings, eight report (help) options, a performance aid, and an option to recall original factory default settings.

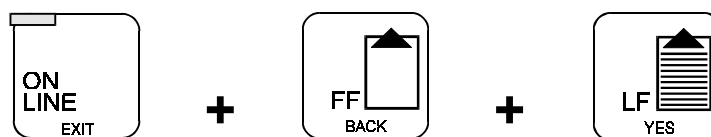
A map of the configuration menu selections and options, along with the original factory defaults (which are underlined>, is shown on Pages 56 through 57. At the extreme right edge of the map are page references for more information.

### ACCESSING THE CONFIGURATION MENU

If the printer is off, press **FORM FEED** while turning on the printer.



If the printer is on, press and hold **ON LINE** and then simultaneously press **FORM FEED** and **LINE FEED**.

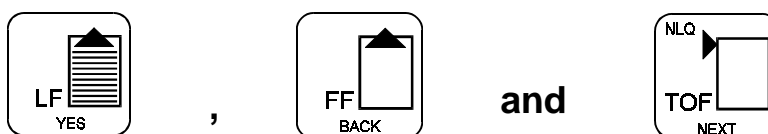


The printer prints out the first line of the configuration menu selection:

HELP OPTIONS

## NAVIGATING THE CONFIGURATION MENU

To move through the menu, you must respond to the menu options and queries using the **YES**, **BACK**, and **NEXT** keys:



For example, in response to "Help Options" above, press **YES**. The printer prints:

Status Print ?

If you do not want a "Status Print," then press **NEXT** to move on to the next configuration item:

Menu Tree ?

If you need to change direction in the menu, you can reverse the query string by pressing **BACK**. This returns you to "Status Print?"

Status Print ?

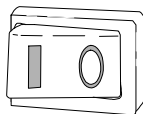
If you change your mind about "Status Print," press **YES** and the printer prints out the present default settings—similar to the one shown on Page 60.

The moment you press **YES** the printer executes the request—either printing out the report or making the default setting change. Also, in the case of a default change, the change also is made to the current (active) printer settings. For example, if you answer **YES** to the "Char/Inch" change (Page 75) from "10" to "12," the change is in effect when you leave the configuration menu.

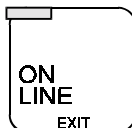
## EXITING THE CONFIGURATION MENU

There are three ways to exit the configuration menu:

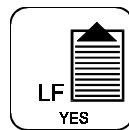
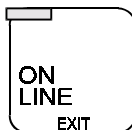
- Turn off the printer.



- Press **EXIT** until the printer advances to the next top of form.



- Press **ON LINE** along with **LINE FEED**.



If you have made default setting changes, the new default selections take effect immediately after exiting the configuration menu or when the printer is turned on again.

If it becomes necessary to return to the factory defaults after configuration changes have been made, the configuration menu includes an option called Factory Reset, which restores the factory default settings. (See "Factory Reset," Page 87.)

## ADJUSTING THE PRINTER'S PERFORMANCE

The best method for adjusting the printer's performance to match your needs is to:

1. Make interface changes (physical printer connections).
2. Make emulation changes (printer behavior: IBM, Epson, or DEC).
3. Make other changes (software and printer configuration menu settings).

The subsections that follow discuss the options and setting selections available through the configuration menu.

Some configuration menu settings are more crucial to printer performance than others.

The printer drivers within a software application often change the printer's status to suit the document being printed; that is, the software temporarily changes the printer's configuration settings. (See Page 33.) For example, if EPSONFX is selected as the printer driver in MS Word 97, Word 97 might need to change the printer's default value of 10 pitch (10 character per in.) to 12 pitch to match your Word 97 character format requirements.

Because of the software's dominance over the printer's settings, it is unnecessary to adjust every setting in the configuration menu unless you intend to print unformatted text, such as Pine or Eudora e-mail messages or .BAT files.

However, because printer drivers do not or cannot change some printer settings, such as the interface or emulation, those settings are important to the printer's function. These settings must be correctly set as default settings so they are in effect when the printer is turned on.

If your printer's configurations are set incorrectly for the interface, the printer driver in the software application cannot change that setting, and your documents will not be printed. If your printer emulation setting does not match the emulation setting in the software, your documents may not be printed or they may be printed incorrectly, with character substitutions and other problems.

If you must change configuration settings—and if those changes include interface and emulation changes—we *advise that you change the interface and/or emulation settings first, before changing other settings*. Also, consider the following guidelines:

- "Interface Option" changes (Page 63).
- If you select "Serial," do not forget to check the "Serial Options" settings (Page 64) for protocol, baud, number of data bits, parity, and the number of stop bits. These must agree with like settings on the computer.
- "Emulation" changes (Page 80).
- The selected emulation also affects the "Character Options" (Page 81).

## CONFIGURATION MAP

CONFIGURATION MAP*		
HELP		
Status Print?	Non-Default List?	Hot Key List?
Menu Tree?	Print All Options?	Diagnostic Codes?
Print Active Character Set?	Print Data Byte Map?	58
INTERFACE OPTIONS		
Active Interface: Serial, <u>Parallel</u>		63
Serial Options (only apply if active interface is serial)		64
Protocol: DTR, X-ON/X-OFF, ETX/ACK, <u>DTR/X-ON/X-OFF</u>		65
DTR Polarity: Low, <u>High</u>		66
Robust X-ON: Off, <u>On</u>		65
X-OFF when Off Line: Off, <u>On</u>		67
Baud: 4800, 2400, 1200, 19200, <u>9600</u>		61
Data Bits: 7 Bits, <u>8 Bits</u>		68
Parity: Even, Odd, Mark, Space, <u>None</u>		69
Stop Bits: 2 Bits, <u>1 Bit</u>		70
Input Buffer Size: Min. (user-defined characters OK), <u>Max. (no user-defined characters)</u>		70
PRINT STYLE		
Near Letter Quality: On, <u>Off</u>		72
Bi-Directional Graphics / NLQ: On, <u>Off</u>		73
Bold Print: On, <u>Off</u>		74
Italics: On, <u>Off</u>		74
Sub/Superscript: On, <u>Off</u>		75
Char/Inch: 12.0, 15.0, 16.67, 17.14, 18.2, 5.0, 6.0, 7.5, 8.33, 8.57, 9.1, <u>10.0</u>		75
Slash Zero: Off, <u>On</u>		76
FORMS OPTIONS		
Lines/Inch: 8 lpi, <u>6 lpi</u>		77
Form Length: 420.0 mm, 297.0 mm, 210 mm, 148.5 mm, 0.5- <u>11.0</u> -31.5 in. <sup>1</sup>		77
Skip Perf: On, <u>Off</u>		78
LF on CR: On, <u>Off</u>		78
CR on LF: Off, <u>On</u>		79
Paper Jam Detect: Off, <u>On</u>		80
Paper Speed: 5 inches/sec, <u>11 inches/sec</u>		80
<sup>2</sup> EMULATION : IBM Proprinter XL, DEC LA210, <u>Epson FX-100</u>		
		80



CHARACTER OPTIONS <sup>3</sup>		
Epson Character Options		82
Epson Control Code Map: Epson IBM #1, Epson IBM #2, <u>Epson</u>		79
Epson Character Map <sup>4</sup> : France, Germany, U.K., Denmark, Sweden, Italy (Epson), Spain, Japan, Norway, Denmark II, Spain II, Latin America, Hebrew, Italy (ANSI), <u>U.S.</u>		84
Epson IBM #1 <sup>5</sup> : Page 850 (Multilingual), 860 (Portugal), <u>437 (U.S.)</u>		84
Epson IBM #2 <sup>6</sup> : Page 850 (Multilingual), 860 (Portugal), 437 (Hebrew), <u>437 (U.S.)</u>		84
IBM Character Options		85
IBM Control Code Map: IBM #2, <u>IBM #1</u>		86
IBM #1 <sup>7</sup> : Page 850 (Multilingual), 860 (Portugal), <u>437 (U.S.)</u>		82
IBM #2 <sup>8</sup> : Page 850 (Multilingual), 860 (Portugal), 437 (Hebrew), <u>437 (U.S.)</u>		86
DEC Character Options		87
DEC Character Set: 7 Bit DEC, <u>8 Bit DEC</u>		89
G0 <sup>9</sup> : France, Germany, U.K., Denmark, Sweden, Italy (ANSI), Spain, Hebrew, Finland, Canada (French), Multilingual, VT100 Line Draw, <u>U.S.</u>		89
G1 <sup>9</sup> : U.S., France, Germany, U.K., Denmark, Sweden, Italy (ANSI), Spain, Hebrew, Finland, Canada (French), Multilingual, <u>VT100 Line Draw</u>		89
G2 <sup>9</sup> : VT100 Line Draw, U.S., France, Germany, U.K., Denmark, Sweden, Italy (ANSI), Spain, Hebrew, Finland, Canada (French), <u>Multilingual</u>		89
G3 <sup>9</sup> : France, Germany, U.K., Denmark, Sweden, Italy (ANSI), Spain, Hebrew, Finland, Canada (French), Multilingual, VT100 Line Draw, <u>U.S.</u>		89
Overlay Characters: OCR A, OCR B, Accept User-Defined Characters, <u>None</u>		90
BARCODE OPTIONS		91
Barcode Strike: Single Strike, <u>Double Strike</u>		91
Barcode Density: 100 dpi, <u>75 dpi</u>		91
SYSTEM OPTIONS		92
Factory Reset		92
Lock Char Set & Emulation: On, <u>Off</u>		92
Initialize Sensitivity: High, <u>Low</u>		93
Vertical Alignment		93

\* Factory defaults are underlined. Page references are on the extreme right. See footnotes on following page.

- 1 0.5-in. increments, including A4 length of 11 2/3 in.
- 2 "EMULATION" does not appear as a configuration menu option if "Lock Character Set and Emulation" is "On."
- 3 "CHARACTER OPTIONS" does not appear as a configuration menu option if "Lock Character Set and Emulation" is "On."
- 4 Only applies if the "Epson Character Set" is "Epson" in the FX-100 emulation.
- 5 Only applies if the "Epson Character Set" is "IBM #1" in the FX-100 emulation.
- 6 Only applies if the "Epson Character Set" is "IBM #2" in the FX-100 emulation.
- 7 Only applies if the "IBM Character Set" is "IBM #1" in the Proprinter emulation.
- 8 Only applies if the "IBM Character Set" is "IBM #2" in the Proprinter emulation.
- 9 G0 is the default for "7 Bit DEC." G0 and G2 are the defaults for "8 Bit DEC." You can assign different graphic map defaults for 7-Bit and 8-Bit DEC.

The following sections explain, in greater detail, the various setting options within the printer's configuration menu. Each option is listed in order under its respective menu heading.

## HELP

### Status Print?

Pressing **YES** prints out the present default settings, similar to the printout on Page 60.

### Menu Tree?

Pressing **YES** prints out a profile of the configuration menu options. "EMULATION" and "CHARACTER OPTIONS" do not appear in the configuration menu tree if "Lock Character Set and Emulation" (Page 92) is "On."

### Non-Default List?

Pressing **YES** prints out a list of the present default settings which differ from the original factory default settings.

### **Print All Options?**

Pressing **YES** prints out a list of all options and all possible option settings.

### **Hot Key List?**

Pressing **YES** prints out a list of all power-on and on-line hot keys.

### **Diagnostic Codes?**

Pressing **YES** prints out a reference list of beep patterns for recoverable and nonrecoverable failures.

## Print Active Character Set?

Pressing **YES** prints out a chart of all present character and control code assignments, similar to those illustrated on Pages 37 through 39. (See "Printing the Active Character Set," Page 35, for more details.)

```
INTERFACE OPTIONS
  Active Interface          Parallel
  Serial Options
    Protocol               DTR/X-ON/X-OFF
    DTR Polarity           High
    Robust X-ON            On
    X-OFF when Off Line    On
    Baud                   9600
    Data Bits              8 bit
    Parity                 None
    Stop Bits              1 bit
    Input Buffer Size       Maximum (no user-defined characters)

PRINT STYLE
  Near Letter Quality      Off
  Bi-Directional Graphics/NLQ Off
  Bold Print               Off
  Sub/Super Script         Off
  Char/Inch                10.0
  Slash Zero               On
```

Status Printout (Partial Example Showing Factory Defaults) JB0-AZ1

## Print Data Byte Map?

Pressing **YES** prints out the present data byte map. Primarily, the data byte map is a troubleshooting and development tool used in customizing character sets.

In content, the present data byte map is similar to the active character set printout. The data byte map not only shows the 256 active character and control code assignments, as does the active character set, but it also identifies the source of the character or code.

Part of a data byte map is shown on Page 63 for Data Bytes 96 through 106. Column headings are explained below. (See the "Universal Control Commands" section for more information concerning data byte maps.) To stop this three-page printout before completion and to move on to the next configuration menu item, press **EXIT**.

**Data Byte.** The decimal data byte number. Data bytes are numbered 0 through 255.

**Action.** Indicates whether the data byte is to be interpreted as a printable character (CHAR) or as a nonprintable control code (CTRL).

**Control Code.** For a CTRL action, this column contains a standard abbreviation\* for the control code. For example, "FF" would indicate the form feed control code. If the data byte does not have a control function, the column contains the abbreviation NUL.

---

\* Appendix D contains a list of standard control code abbreviations.

Source: This is the memory source of the character or control code. The two possibilities are ROM and RAM:

- ROM stands for read only memory which is permanent memory.
- RAM stands for random access memory which is temporary memory. Character and control codes residing in RAM are lost when the printer is turn off. (See "Character Library" which follows.)

Character Library. Always Character Library 0 if the source is RAM. For ROM there are two possibilities (Character Libraries 0 and 1). The source/character library combinations are listed below:

Source	Character Library	Type of Character
ROM	0	Any built-in character except an OCR B Character
ROM	1	OCR B Character
RAM	0	Downloaded Character

Character Number. Each character within a character library is assigned a number. (Appendix D contains more detail on this.)

Character. The actual printable character presently assigned from a character library. The character is printed for that data byte if the printer action is set to CHAR.

DATA BYTE	ACTN	CTRL CODE	SRC	LIB	CHAR NUM	CH
096	CHAR	NUL	ROM	0	096	`
097	CHAR	NUL	ROM	0	097	a
098	CHAR	NUL	ROM	0	098	b
099	CHAR	NUL	ROM	0	099	c
100	CHAR	NUL	ROM	0	100	d
101	CHAR	NUL	ROM	0	101	e
102	CHAR	NUL	ROM	0	102	f
103	CHAR	NUL	ROM	0	103	g

Data Byte Map (Partial Printout, Example)

JB0-BA

## INTERFACE OPTIONS

Pressing **YES** prints out the first of the interface options listed below:

- Active Interface •
- Serial Options
- Input Buffer Size

### Active Interface

Pressing **YES** prints out the active interface setting:

- Parallel (factory default)
- Serial

Whenever you change the active interface, make sure that it matches the interface selection on the computer. Do not forget to change cables and connect them to the proper connectors on the back of the printer and computer.

Parallel. Enables communication on the parallel interface connector on the back of the printer. For information concerning parallel communications, see Appendix C.

Serial. Enables communication on the serial interface connector on the back of the printer. For information concerning serial communications, see Appendix B.

If you select "Serial," double-check the serial interface settings under "Serial Options"—the next configuration menu item.

## **Serial Options**

Pressing **YES** prints out the first of the serial options listed below:

- Protocol •
- DTR Polarity
- Robust X-ON
- X-OFF When Off Line
- Baud
- Data Bits
- Parity
- Stop Bits

If the active interface is "Serial," then the settings for serial options must match those of the computer.



## Protocol

Pressing **YES** prints out the present protocol setting:

- DTR/X-ON/X-OFF (factory default)
- DTR
- X-ON/X-OFF
- ETX/ACK

Protocol refers to the "handshaking" technique used for serial communication. For more information concerning hardware and software handshaking techniques, see Appendix B.

DTR/X-ON/X-OFF. Combines hardware handshaking, using the DTR signal, with software handshaking, using X-ON/X-OFF.

DTR. Stands for data terminal ready. The printer sets the DTR signal high when it is ready to receive data from the computer.

DTR is hardware-oriented handshaking initiated by the printer.

X-ON/X-OFF: Stands for Transmission On/Transmission Off. The printer sends the X-ON status, using device control code 1 (DC1), to the computer when it is ready to receive data. The X-OFF status, using DC3, is sent when the printer is busy receiving and processing data. (Also see, "Robust X-ON" and "X-OFF When Off Line," the next configuration menu items.)

X-ON/X-OFF is software-oriented handshaking initiated by the printer.

ETX/ACK. Stands for End of Text/Acknowledge. The computer sends the ETX code to the printer after each line of characters. The computer waits for the ACK code from the printer before sending the next line of characters.

ETX/ACK is software-oriented handshaking initiated by the computer.

### **DTR Polarity**

Pressing **YES** prints out the present setting:

- High (factory default)
- Low

See “Hardware Handshaking” in Appendix B.

### **Robust X-ON**

Pressing **YES** prints out the present setting:

- Off
- On (factory default)

The robust setting only applies to the X-ON/X-OFF protocol.

Off. The printer transmits X-ON only once when it is ready to receive data.

On. The printer transmits X-ON to the computer every 20 seconds if it is ready and waiting for data from the computer.

### **X-OFF When Off Line**

Pressing **YES** prints out the present setting:

- Off
- On (factory default)

The "X-OFF when Off Line" setting only applies to the X-ON/X-OFF protocol.

Off: If the printer has transmitted X-ON to the computer prior to being switched off line, the printer remains in the X-ON state until it receives

data from the computer. Although the printer will not print data, the computer can send data to the printer.

On: The printer transmits X-OFF to the computer when it goes off line. The printer will not accept or print data.

### **Baud**

Pressing **YES** prints out the present baud setting:

- 19200
- 9600 (factory default)
- 4800
- 2400
- 1200

Baud is the speed at which serial information flows between the computer and printer. In general, the higher the baud value, the faster this interface speed. Print speed, however, is maximized at a serial interface speed of 9600 baud, the factory default.

### **Data Bits**

Pressing **YES** prints out the present setting:

- 8 Bits (factory default)
- 7 Bits

This defines the number of data bits in each byte transmitted between computer and printer.

8 Bits: Commonly, an eight-bit byte is necessary for graphics. Eight bits also allows access to all of the character and control data bytes (0-255) in the character sets.

7 Bits: Limits the printer's ability to handle graphics and restricts it to accessing only the lower character and control data bytes (0-127) in the character sets.

### **Parity**

Pressing **YES** prints out the present parity bit status:

- None (factory default)
- Even
- Odd
- Mark
- Space

The parity bit follows the data byte transmitted from the computer to the printer. The printer can use even or odd parity to check that all data bits from the computer were received correctly.

None: No parity check.

Even: Data bits are either binary 0 or binary 1. For even parity, all of the data bits must add up to an even decimal sum. If not, the parity bit is set to binary 1 to make it so.

Odd: All of the data bits must add up to an odd decimal sum. If not, the parity bit is set to binary 1 to make it so.

Mark: Parity bit is always binary 1.

Space: Parity bit is always binary 0.

## Stop Bits

Pressing **YES** prints out the present stop bit status:

- 1 Bit (factory default)
- 2 Bits

The printer uses the stop bit(s) to detect the space in-between data bytes. The stop bit follows the parity bit if parity is enabled.

1 Bit: One bit is sufficient for the printer and most modern computers.

2 Bits: Consider using two stop bits if you transmit at a relatively high baud using an older, slower computer.

## Input Buffer Size

Pressing **YES** prints out the present setting:

- Maximum (no user-defined characters) (factory default)
- Minimum (user-defined characters OK)

The printer contains a 32K RAM, part of which is available as an input buffer. The input buffer is used for storing print data, graphics, and user-defined characters. If you download and retain user-defined characters, you decrease the amount of memory available for input print data.

Maximum (no user-defined characters): All of the input buffer is reserved for input print data. User-defined, downloaded (custom) characters are rejected.\*

Minimum (user-defined characters OK): The minimum amount of space assigned to the input buffer for print data is reduced to 532 bytes. The rest is used to accommodate custom characters downloaded from the

---

\* Maximizing the input buffer size does not affect the use of graphic fonts, such as TrueType fonts. The restriction only applies to custom characters downloaded using universal control commands.

computer using universal control commands. You can then specify up to 128 custom characters.

Even if you do not intend to download custom characters, minimizing the input buffer to 532 bytes has some side-effect advantages. Consider minimizing the buffer size to minimize:

- Data loss due to possible power, network, or computer failures
- Dedicated computer-to-printer transmission time

*Note:* Storing downloaded characters does not activate them. After you download a character or characters using universal control commands, you must "map" them into the active character set using still other universal control commands or the "Accept User-Defined Characters" setting (Page 90) under "Overlay Characters" in the configuration menu. Only then does "Print Active Character Set" (Page 54) and "Print Data Byte Map" (Page 61) reveal the character substitution(s).

## PRINT STYLE

Pressing **YES** prints out the first of the print style options listed below:

- Near Letter Quality •
- Bi-Directional Graphics / NLQ
- Bold Print
- Italics
- Char/Inch
- Slash Zero

Other print style settings are available using universal and emulation control commands.

### Near Letter Quality

Pressing **YES** prints out the active NLQ status:

- Off (factory default)
- On

Off: The printer prints draft quality characters. Draft quality printing is about three to four times as fast as that of NLQ printing.

Draft characters can be bolded and/or italicized.

*Note:* Optical character recognition (OCR) fonts cannot be printed in draft quality mode.

**On:** The printer prints near letter quality (NLQ) characters in 10 12, and 15 pitch (10, 12, and 15 char/in.). NLQ characters have about two to three times the dot density of draft quality characters. NLQ characters are more attractive than comparable draft quality characters.

Most NLQ characters can be bolded and/or italicized.

## **Bi-Directional Graphics / NLQ**

Pressing **YES** prints out the active NLQ status:

- Off (factory default)
- On

Normally, all draft text is printed bi-directionally, that is, on right-to-left as well as left-to-right passes of the printhead carriage. This option lets you enable or disable bi-directional printing of all non-draft text and graphics. Non-draft text and graphics include graphical images, barcodes (except PostNet printed as text), and NLQ text.

Consider enabling bi-directional printing if you normally print NLQ text and/or routinely include graphics. Bi-directional printing approximately doubles throughput, thereby increasing efficiency. Enabling bi-directional printing overrides all uni-directional printing control commands sent by the host.

Consider disabling bi-directional printing if barcode readability is a problem. (Also, setting the "Barcode Density" in the configuration menu from 75 dpi to 100 dpi may enhance readability.)



## Bold Print

Pressing **YES** prints out the active interface setting:

- Off (factory default)
- On

Off: The printer prints standard normal-weight characters.

On: The printer prints bolded characters. Bold (or emphasized) characters appear "fatter" than normal-weight characters.\* Since bolding is usually reserved for emphasis, rather than paragraph text, bolding does not appreciably slow down the print speed.

Bold characters can also be italicized.

*Note:* Optical character recognition (OCR) fonts cannot be bolded.

## Italics

Pressing **YES** prints out the active setting:

- Off (factory default)
- On

Off: The printer prints standard upright characters.

On: The printer prints italicized characters. Italicized characters appear slanted.

Italicized characters can be bolded.

---

\* To make a bolded character from a normal-weight character, the printer simply prints another image of the character slightly to the right of the first.

*Note:* Characters can only be italicized in the Epson emulation. Also, barcodes and optical character recognition (OCR) fonts cannot be italicized.

## **Subscript/Superscript**

Pressing **YES** enables you to include subscripts and superscripts in your text. Subscript and superscript printing slightly affects overall print speed.

## **Char/Inch**

Pressing **YES** prints out the active pitch (characters printed per horizontal inch):

- |        |                          |
|--------|--------------------------|
| • 5.0  | • 10.0 (factory default) |
| • 6.0  | • 12.0                   |
| • 7.5  | • 15.0                   |
| • 8.33 | • 16.67                  |
| • 8.57 | • 17.14                  |
| • 9.1  | • 18.2                   |

*Note:* Although optical character recognition (OCR) characters can be printed in any pitch, OCR character are normally used in 10 pitch only.

## Slash Zero

Pressing **YES** prints out:

- Off
- On (factory default)

Off: The printer prints zeroes without a slash.

On: The printer prints zeroes with a slash.

*Note:* Optical character recognition (OCR) zeroes cannot be slashed.

## FORMS OPTIONS

Pressing **YES** prints out the first of the forms options listed below:

- Lines/Inch •
- Form Length
- Skip Perf
- LF on CR
- CR on LF
- Paper Jam Detect
- Paper Speed

## Lines/Inch

Pressing **YES** prints out the active line space setting:

- 6 lpi (factory default)
- 8 lpi

This sets the number of lines per vertical inch. For an 11 in. form, the printer prints a maximum of 66 lines at 6 lpi or 88 at 8 lpi.

## Form Length

Pressing **YES** prints out the active form length setting:

- 0.5 in. to 31.5 in. in .5 in. increments (11 in. is factory default)
- $11\frac{2}{3}$  in. (standard A4 length for continuous forms)
- 420.0 mm
- 297.0 mm
- 210 mm
- 148.5 mm

Normally, the form length is the vertical distance between horizontal perforations. However, any evenly divisible or multiple of this length to the half inch can be used. For example, if you print on fanfolded  $1\frac{1}{2}$  in. label stock, you might want to set the form length to  $1\frac{1}{2}$  in. rather than the actual distance between horizontal perforations.\*

---

\* 12 in. is a standard vertical distance between horizontal perforations on some fanfolded label stock.

## **Skip Perf**

Pressing **YES** prints out:

- Off (factory default)
- On

Off: The printer prints across the horizontal perforation, unless instructed otherwise by the computer's software application.

This is the preferred setting in most instances. In general, leave it off if you print on label stock.

On: The printer automatically leaves a ½ in. white space before and after the TOF setting.

Consider using the "on" setting when printing unformatted ("straight ASCII") text.

## **LF on CR**

Pressing **YES** prints out:

- Off (factory default)
- On

*Note:* Regardless of this setting, the printer automatically performs a printer-supplied line feed and carriage return when the output line buffer is full.

Off: The printer does not supply a line feed command after it executes a carriage return command sent from the computer.

This is the preferred setting since most computer software applications supply all vertical positioning commands.

On: The printer automatically supplies a line feed for every carriage return command from the computer. (Sometimes referred to as Auto Line Feed.)

## **CR on LF**

Pressing **YES** prints out:

- Off
- On (factory default)

*Note:* Regardless of this setting, the printer automatically performs a printer-supplied line feed and carriage return when the line buffer is full.

Off: The printer does not automatically supply a carriage return command after it executes a line feed command sent from the computer.

On: The printer automatically supplies a carriage return for every line feed command from the computer. (Sometimes referred to as Auto Carriage Return.) This is the preferred setting since most modern software applications assume that line feeds cause the printer to print out the line of text, empty its print buffer, and then reset the character cursor to the first character position.

## Paper Jam Detect

Pressing **YES** prints out:

- Off
- On (factory default)

The printer uses a paper motion sensor on top of the left tractor to detect paper jams. If the paper is supposed to move but it does not, then the printer flashes the **PAPER** indicator and sounds the beeper.

Off: Disables paper jam detection.

On: Enables paper jam detection.

## Paper Speed

Pressing **YES** prints out:

- 11 in./sec (factory default)
- 5 in./sec

This is often referred to as the slew rate.

11 in./sec: This the normal slew rate for single-part 18 lb paper.

5 in./sec: Consider using this slower slew rate for very light, heavy, or multipart paper. The slower slew rate is gentler on the paper's sprocket holes.

## EMULATION

*Note:* "Emulation" cannot be changed and does not appear as a configuration menu option if "Lock Character Set and Emulation" (Page 92) is set to "On."

Pressing **YES** prints out the active emulation:

- Epson FX-100 (factory default)
- IBM Proprinter XL
- DEC LA210

## CHARACTER OPTIONS

*Note:* "Character Options" cannot be changed and does not appear as a configuration menu option if "Lock Character Set and Emulation" (Page 92) is set to "On."

Pressing **YES** prints out the first of the character options listed below:

- Epson Character Options •
- IBM Character Options
- DEC Character Options
- Overlay Characters

A character set contains assignment for up to 256 character and control codes. Each emulation offers at least two character set variations, along with other variations based on the language and/or country.



Each emulation has a default character set. The factory default character sets for the 4100 printer are English-language U.S.A. The factory default U.S. Epson, IBM, and DEC character sets are illustrated on Pages 39 through 43. If desired, you may map over the U.S. English characters with French, Swedish, U.K. English, Multilingual characters, and so on, depending on the emulation.

*Note:* The factory default emulation is Epson FX-100, therefore, the character set in effect when you turn on the printer for the first time is the U.S. Epson Character Set. If you then switch, for example, to the IBM Proprinter XL emulation as your default emulation, then the U.S. IBM #1 Character Set is in effect when the printer is turned on.

Besides the character options available within an emulation, you can also overlay parts of the active language-biased character set with optical character recognition (OCR) characters. You can even overlay particular character set characters with your own characters downloaded from the computer using universal control commands.

To check out the active character and control code assignments, use the "Print Active Character Set" menu selection (Page 36).

## Epson Character Options

Pressing **YES** prints out the first of the Epson character options listed below:

- Epson Control Code Map •
- Epson Character Map
- Epson IBM #1
- Epson IBM #2

An Epson FX-100 printer contains a basic or native character set plus two variations of IBM character sets: Epson, Epson IBM #1, and Epson IBM

#2. Although only one character set can be the default character set for the Epson emulation, you can assign a national-use character map or a code page default for each of the three.

*Note:* Do not confuse the IBM #1 and IBM #2 character sets available in the Epson emulation with those of the IBM emulation. The selections you make for the Epson emulation do not affect those of the IBM emulation, and vice versa.

### **Epson Control Code Map**

Pressing **YES** prints out the present Epson control code map selection:

- Epson (factory default)
- IBM #1
- IBM #2

Epson: The U.S. Epson Character Set (Epson control code map + U.S. national-use character map) is shown on Page 39. Instead of the U.S. national-use character map, you can select one of 11 others under "Epson Character Map," Page 84.

IBM #1: The U.S. IBM #1 Character Set (IBM #1 control code map + U.S. national-use character map) is shown on Page 41. Instead of the U.S. national-use character map—IBM calls this Code Page 437—you can select the multilingual or Portuguese character map under "Epson IBM #1 Code Page," Page 84.

IBM #2: The U.S. IBM #2 Character Set is similar to the one shown on Page 41 except that Columns 8 and 9 contain characters rather than control codes. Instead of the U.S. national-use character map, you can select the multilingual, Portuguese, or Hebrew character map under "Epson IBM #2 Code Page," Page 84.

### **Epson Character Map**

Pressing **YES** prints out the present Epson national-use character map selection:

- United States (factory default)
- France
- Germany
- United Kingdom
- Denmark
- Sweden
- Italy (Epson)
- Spain
- Japan
- Norway
- Denmark II
- Spain II
- Latin America
- Hebrew
- Italy (ANSI)

For more information on Epson national-use character maps, see Appendix D.

### **Epson IBM #1 Code Page**

Pressing **YES** prints out the present Epson emulation code page selection for the IBM #1 character set:

- Code Page 437 (U.S.), (factory default)
- Code Page 850 (Multilingual)
- Code Page 860 (Portugal)

For more information on IBM code pages, see Appendix D.

### **Epson IBM #2 Code Page**

Pressing **YES** prints out the present Epson emulation code page selection for the IBM #2 character set:

- Code Page 437 (U.S.), (factory default)
- Code Page 850 (Multilingual)
- Code Page 860 (Portugal)
- Code Page 437 (Hebrew)

For more information on IBM code pages, see Appendix D.

### **IBM Character Options**

Pressing **YES** prints out the first of the IBM character options listed below:

- IBM Control Code Map •
- IBM #1 Code Page
- IBM #2 Code Page

An IBM Proprinter XL printer contains two variations of IBM character sets: IBM #1 and IBM #2. Although only one character set can be the IBM default character set, you can assign a code page default for each of them.

Code pages is the term IBM uses to refer to its national-use character maps.

## **IBM Control Code Map**

Pressing **YES** prints out the present IBM control code map selection:

- IBM #1 (factory default)
- IBM #2

**IBM #1:** The U.S. IBM #1 Character Set (IBM #1 control code map + U.S. national-use character map) is shown on Page 41. Instead of the U.S. national-use character map—IBM calls this Code Page 437—you can select the multilingual or Portuguese character map under "IBM #1 Code Page" in the next subsection.

**IBM #2:** The U.S. IBM #2 Character Set is similar to the one shown on Page 41 except that Columns 8 and 9 contain characters rather than control codes. Instead of the U.S. national-use character map, you can select the multilingual, Portuguese, or Hebrew character map under "IBM #2 Code Page," Page 86.

## **IBM #1 Code Page**

Pressing **YES** prints out the present IBM emulation code page selection for the IBM #1 character set:

- Code Page 437 (U.S.), (factory default)
- Code Page 850 (Multilingual)
- Code Page 860 (Portugal)

For more information on IBM code pages, see Appendix D.

### **IBM #2 Code Page**

Pressing **YES** prints out the present IBM emulation code page selection for the IBM #2 character set:

- Code Page 437 (U.S.), (factory default)
- Code Page 850 (Multilingual)
- Code Page 860 (Portugal)
- Code Page 437 (Hebrew)

For more information on IBM code pages, see Appendix D.

## DEC Character Options

Pressing **YES** prints out the first of the DEC character options listed below:

- DEC Character Set •
- Character Map G0
- Character Map G1
- Character Map G2
- Character Map G3

A DEC LA210 printer contains two variations of DEC character sets: one called the 7-Bit DEC and the other the 8-Bit DEC. Although only one character set can be the DEC default character set, you can assign national-use character map(s) to each of them.

You specify national-use character maps in G0 through G3. (DEC refers to G0 through G3 as graphics maps.) When the printer is turned on, G0 is automatically assigned to either:

- The 7-Bit DEC Character Set
- The lower half of the 8-Bit DEC Character Set (G2 is automatically assigned to the upper half of the 8-Bit DEC Character Set\*)

You can specify one of 12 default national-use character maps or a multilingual character map for each graphics map.

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\* Although these power-on defaults cannot be changed, G0, G1, G2, G3 can be re-assigned, *after* turning on the printer, by using DEC control commands. (G0 can only be assigned to data bytes 0-127.)

## DEC Character Set

Pressing **YES** prints out the present DEC character set configuration:

- 8 Bit DEC (factory default)
- 7 Bit DEC

8 Bit DEC: The U.S./Multilingual 8-Bit DEC Character Set (8-bit control code map + G0 & G2 character maps) is shown on Page 43. Instead of the U.S. or multilingual character map, you can select one of 11 others using the character (graphics) maps.

7 Bit DEC: The U.S. 7-Bit DEC Character Set is the left-hand half of the 8-bit character set shown on Page 43. Instead of the U.S. national-use character map, you can select multilingual or one of 11 others using the character (graphics) maps.

## Character Maps G0 through G3

Pressing **YES** to G0, G1, G2, or G3 prints out the present national-use graphics map selection:

- |   |                   |
|---|-------------------|
| • Multilingual (G2 factory default)       | • Sweden          |
| • VT100 Line Draw (G1 factory default)    | • Italy (ANSI)    |
| • United States (G0 & G3 factory default) | • Spain           |
| • France                                  | • Hebrew          |
| • Germany                                 | • Finland         |
| • United Kingdom                          | • Canada (French) |
| • Denmark                                 |                   |

For more information on DEC national-use graphic maps, see Appendix D.



## Overlay Characters

Pressing **YES** prints out the present settings:

- None (factory default)
- OCR A
- OCR B
- Accept User-Defined Characters

You can alter any active character set by overlaying one or more characters with either a predefined or a customized character map.

The printer contains two sets of predefined optical character recognition (OCR) maps. If you press **YES** to either OCR A or OCR B, the printer overlays some of the characters in the active characters set with these OCR characters. Your selection also becomes the default condition when you turn on the printer; for example, if you have selected the OCR A overlay and the NLQ\* mode as defaults, then the active characters are OCR A characters when you turn on the printer. See Appendix D for OCR character maps.

If you press **YES** to "Accept User-Defined Characters," then downloaded characters presently in and/or subsequently downloaded to RAM using universal control commands can be mapped to the active character set. For the printer to accept downloaded customized characters, "Input Buffer Size" must be set to "Minimum" (Page 70). Unlike ROM-resident OCR characters, RAM-resident downloaded characters are lost when you turn off the printer.

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\* OCR characters are only allowed in Near Letter Quality (NLQ) mode. You cannot print OCR in draft quality mode.

## BARCODE OPTIONS

Pressing **YES** prints out the first of the barcode options listed below:

- Barcode Strike •
- Barcode Density

### Barcode Strike

Pressing **YES** prints out the active setting:

- Double Strike (factory default)
- Single Strike

**Double Strike:** For barcodes, double strike is analogous to bold text. For this, the printhead carriage moves slightly to the right and reprints the same single-strike pattern.

**Single Strike:** For barcodes, single strike is analogous to normal text. The width of a single strike varies, depending on the barcode symbology. For more on this, see Appendix E.

### Barcode Density

Pressing **YES** prints out the active setting:

- 75 dpi (factory default)
- 100 dpi

**75 dpi:** For barcodes, 75 dpi is analogous to draft quality mode. If the barcode reader successfully reads a low-density barcode, choosing the 75 dpi barcode density increases printer throughput. The 75 dpi setting may actually enhance readability.

**100 dpi:** For barcodes, 100 dots per in. is analogous to near letter quality mode. Use 100 dpi for USPS PostNet.

## SYSTEM OPTIONS

Pressing **YES** prints out the first of the system options listed below:

- Factory Reset
- Lock Character Set and Emulation
- Initialize Sensitivity
- Vertical Alignment

### Factory Reset

*Note:* If you reset the configuration menu settings to factory defaults, all custom characters previously downloaded with universal control commands are lost.

Press **YES** to reset all configuration menu settings to factory defaults.

Before actually resetting, the printer prints "Reset Menu Settings to Defaults?" Press **YES** to execute the factory reset. After a couple of seconds, the printer prints "Reset Done."

### Lock Character Set and Emulation

Pressing **YES** prints out the active setting:

- Off (factory default)
- On

Pressing **YES** to "On" causes the printer to hide configuration menu selections for "Emulation" (Page 80) and "Character Options" (Page 81).

With the character set and emulation locked, the options, queries, and settings for "Emulation" and "Character Options" do not appear as you navigate through the configuration menu. However, the emulation and

character set settings and options are printed out when you select "Status Print?" (Page 56) or "Print All Options?" (Page 58).

## **Initialize Sensitivity**

Pressing **YES** prints out the active setting:

- Low (factory default)
- High

The initialize sensitivity setting applies only to the INIT\* signal (Pin 31) on the parallel interface.

Low: Low sensitivity means that the printer requires an active-low INIT\* pulse of at least 100 ms in order to reset the printer to its power-up default settings.

In most situations, prefer low sensitivity, especially when using overly long parallel interface cables (over 10 ft) or when dealing with an electronically noisy computer-printer connection.

High: High sensitivity means that the printer requires an active-low INIT\* pulse of at least 1.66  $\mu$ s in order to reset the printer to its power-up default settings.

Use high sensitivity when the INIT\* pulse is short, such as with an IBM 3197 terminal.

## **Vertical Alignment**

Pressing **YES** allows you to adjust the printer's right-versus-left-pass timing for firing printhead pins. See "Vertical Image Alignment" (Page 110) for the procedure.

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# Maintenance

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## WARNINGS !

- ! Turn off printer and unplug power cord before attempting any maintenance procedure.
- ! Hazardous voltages are present in the 4100 printer. Equipment repair must be performed only by service-trained personnel who are aware of the hazards involved.
- ! Double-Pole/Neutral Fusing. The 4100 printer contains two fuses in the power receptacle. It is possible for only one fuse to blow. If this occurs, be warned that, even though the **POWER** indicator is not lit, some printer electrical circuit may remain active. ALWAYS turn off the printer and unplug the power cord before checking the cause of the blown fuse(s) and before replacing the fuse(s).
- ! Use only the fuses specified. Never use repaired fuses, and never short-circuit a fuse holder.

## STATIC ELECTRICITY

Static electricity occurs when objects become electrically charged. When charged with static electricity, objects tend to attract or repel other objects.

Static electricity can build up on paper. The printer paper can become charged with static electricity as it moves from the feeder slot to the printer's acoustic hood. If the static electricity is not discharged from the paper as it exits the printer, the paper tends to cling to the printer (or printer stand) and resist stacking.

Fortunately, the acoustic hood is designed to draw off this static electricity. For this reason, the manufacturer recommends that you always use the acoustic hood to reduce static electricity, as well as to reduce printer noise. If you do use the printer without the acoustic hood, there are still ways to control or eliminate static electricity.

Temperature, humidity, and other factors influence static buildup:

- Low relative humidity tends to encourage static buildup. Prefer to keep the relative humidity in the printer room above 40%.

In general, since warmer environments tend to have higher relative humidity levels, prefer a warmer room to a colder one.

- Avoid storing paper in an overly dry location. Instead, store paper at the same temperature and humidity levels of the printer, or allow paper to acclimate overnight before loading that paper in the printer.

Besides encouraging static electricity, an overly dry location robs paper of its built-in moisture content. (Typically, 5% of paper weight is water.) When paper loses this built-in moisture, it curls.

- Wool, as well as many synthetic carpeting materials, are notorious for causing static electricity. If the site has carpeting, consider using an anti-static spray on the area surrounding the printer or place an anti-static mat under the printer stand. If you use an anti-static spray, do not spray the printer or the paper.

## CLEANING

**Warning !** Remember to turn off power and unplug the printer before cleaning interior or exterior surfaces.

### INTERIOR SURFACES

Paper dust is inevitable. If desired, use a vacuum cleaner to remove paper dust from the area beneath the ribbon cartridge and printhead carriage. Prefer using a vacuum cleaner specially designed for electronic equipment. Avoid canned or compressed air, which can force dust and dirt into printer mechanisms.

Before you vacuum, remove the ribbon cartridge (Page 99). While you vacuum, move the printhead carriage from side to side to vacuum debris from under the carriage path. Do not force vacuum attachments into hard-to-reach places; and limit vacuuming to the area directly beneath the cartridge and carriage. Absolute cleanliness is not necessary.

Never use a liquid cleaner—including soap and water—inside the printer.

## EXTERIOR SURFACES

Surfaces, including the operator access window, can be cleaned with a soft cloth dampened with soap and water. (Remember: The cloth should be moist—not dripping wet.)

Avoid petroleum-based cleaners and solvents such as lighter fluid, paint thinner, and the like. If necessary, use a commercial cleaner, such as **409\***, to clean ink from surfaces. When using a spray, apply the cleaner to a soft cloth and then apply to the printer. Isopropyl alcohol (70%-90%) can be used instead of a commercial cleaner, except as noted below.

**Caution !** DO NOT use alcohol on the switch panel. Alcohol, if it seeps beneath the keypad, weakens the adhesive that binds the keypad laminates.

## LUBRICATION

Periodic lubrication is not required.

All moving parts are either lubricated for life or require no special periodic lubrication. In fact, unwarranted lubrication could cause damage or impaired performance.

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\* 409 is a brand name of The Clorox Company.

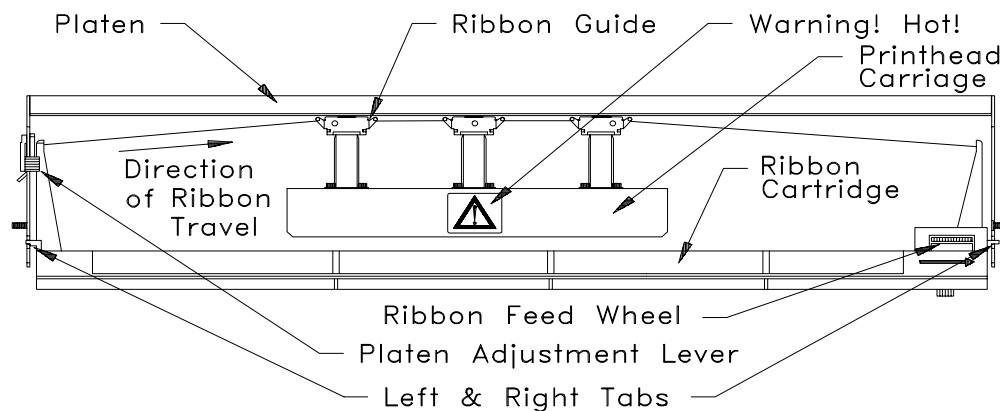


## CHANGING RIBBON CARTRIDGE

**Important !** For best results and longest printer life, insist on genuine, factory-approved, ribbon cartridges. (Re-inked or remanufactured ribbon cartridges are not suitable.) Obtain factory-approved ribbon cartridges from your dealer or directly from the printer manufacturer. See the front of this operator's guide for information on ordering ribbon cartridges.

Replace the ribbon cartridge if it becomes frayed or the print density is too light. Replace with a genuine, factory-approved ribbon cartridge.

Refer to the following illustration for removing and installing a ribbon cartridge.



Ribbon Cartridge (Top View of Operator Access)

JB0-AP

To remove a ribbon cartridge, proceed as follows:

**Warning !** After printing, printheads are *hot*.

*Note:* You need not remove paper to change the ribbon cartridge.

1. Turn off the printer or place printer off line.
2. Open the operator access door.
3. Move the printhead carriage to the center of the printer.
4. Move the printhead gap adjustment lever as far as possible toward the front of the printer to open the gap as wide as possible between the platen and printheads.
5. Pull up all of the ribbon guides to remove them from their printheads.
6. Lift the cartridge straight up and out of the printer.

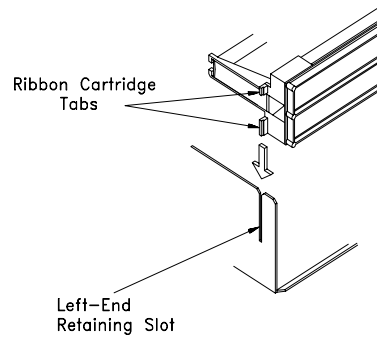
To install a ribbon cartridge, proceed as follows:

*Note:* Replacement ribbon cartridges include three ribbon guides. The three ribbon guides are only loosely attached to the ribbon. If a ribbon guide has come off the ribbon, see "The Clean Way to Re-attach a Ribbon Guide," (Page 103).

1. Move the ribbon guides toward the center of the ribbon, and make sure the ribbon is taut.

If necessary, turn the ribbon feed wheel in the direction of the arrow until the ribbon is taut.

2. Insert the ribbon cartridge into the printer so that the tabs on the right and left ends of the ribbon cartridge slip through the slots provided in the operator access way. Guide the tabs into the retaining slots provided at each end of the printer mechanism.



### Installing Ribbon Cartridge (Left-End View)

JB0-AT

3. Gently press down on the cartridge until it quietly snaps into place.
4. Be sure the ribbon is taut and then slip the ribbon guides onto the printheads.
5. Take up the slack again and then check the ribbon for twists.

Make sure that the ribbon is not obstructed or bound up at the cartridge's entrance and exit slots.

6. Manually slide the printhead carriage back and forth.

If the ribbon feed wheel spins (on the left-to-right pass of the carriage), the ribbon cartridge is installed correctly. If not, remove the cartridge and re-install.

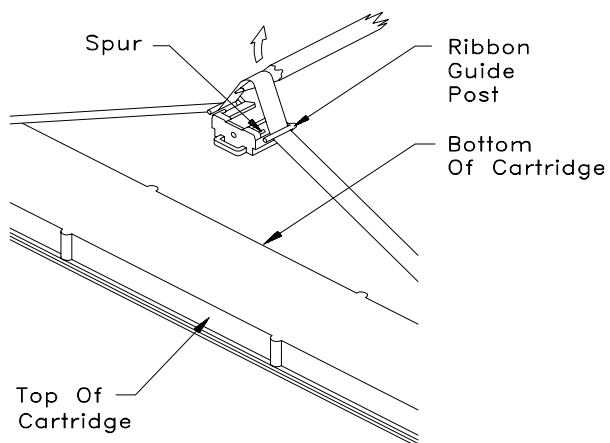
7. Adjust the printhead gap using the printhead gap adjustment lever. (If necessary, see "Adjusting the Printhead Gap," Page 27.)

### The Clean Way To Re-Attach a Ribbon Guide

1. Lay the ribbon cartridge face down on a table, as shown below.
2. Make sure the ribbon is taut. If not, turn the ribbon feed wheel in the direction of the arrow until the ribbon is taut.
3. Determine the proper position of the ribbon guide.

The ribbon guides are labeled **Left**, **Middle**, and **Right**. The guides are physically different and therefore not interchangeable.

4. Hold a pencil under the ribbon, as shown below, and slip on the ribbon guide so that the handle on the ribbon guide is at the top of the cartridge. The ribbon should be positioned under the ribbon guide posts.
5. Remove the pencil and use it to slip the ribbon under the spurs on the guide.



### The Clean Way To Re-Attach a Ribbon Guide

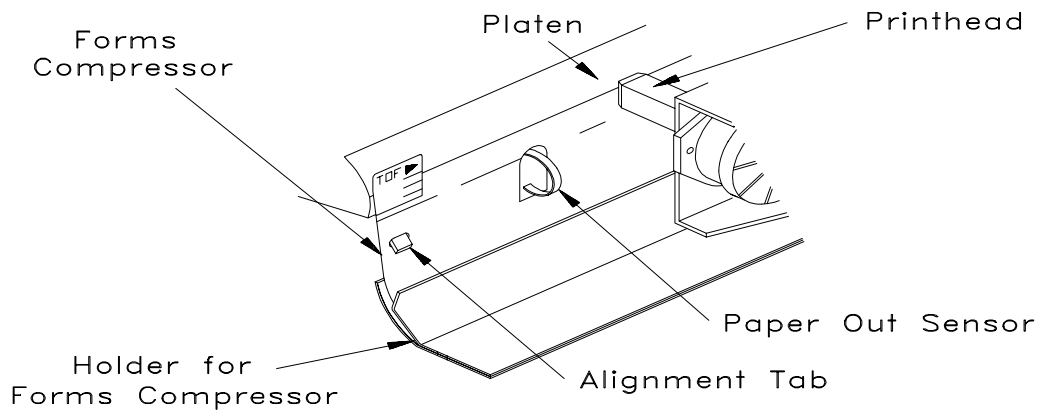
## CHANGING FORMS COMPRESSOR

The forms compressor is located between the platen and the printhead carriage, as shown in the illustration. Its purpose is to hold the paper flat against the platen during printing.

Forms compressor replacement is required only if it is broken, bent, or worn.

To change a forms compressor, proceed as follows:

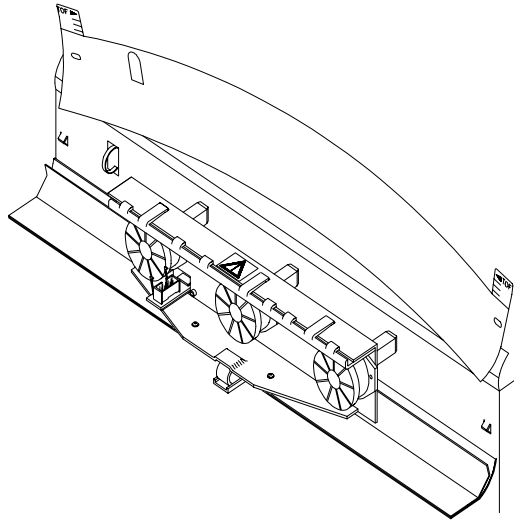
1. Turn off printer and unplug the power cord.
2. Open the operator access door.
3. Note the setting of the printhead gap adjustment lever and then remove paper and ribbon cartridge. (If necessary, see "To remove a ribbon cartridge," Page 100.)
4. Make sure the printhead gap adjustment lever is toward the front of the printer as far as possible.



Forms Compressor (Left End)

JB0-AR1

5. Lift the forms compressor off the alignment tabs near both ends.
6. Make sure the forms compressor clears the paper out sensor, and then lift the forms compressor out of the printer.
7. Slightly bend the new forms compressor, as shown in the following illustration, and slip past the printheads.
8. As you push the forms compressor down, keep it bent on the left side so that it clears the paper out sensor.



### Installing a Forms Compressor

JB0-AS1

9. Tuck the bottom of the forms compressor into the holder at the bottom of the printer compartment, and then adjust the forms compressor side to side so that it fits over the alignment tabs.
10. Make sure that the paper out sensor protrudes through its hole in the forms compressor and recheck that the forms compressor is correctly positioned over the alignment tabs.
11. Re-install the ribbon cartridge (Page 100) and paper (Page 21).



## CHANGING FUSES

**Caution !** Double pole/neutral fusing.

The printer contains two fuses in a compartment just above the power receptacle near the left-rear corner of the printer.

If a fuse "blows," turn off power and unplug the power cord. Attempt to find the cause of the blown fuse before putting in a new fuse or fuses.

To change a fuse, proceed as follows:

1. Note the voltage selection in the window of the fuse compartment.
2. Use a small, flat-blade screwdriver to open fuse compartment, as shown in the illustration on Page 109.
3. Pull out voltage selection tumbler.
4. Pull out fuse holder(s).
5. Check blown fuse(s).

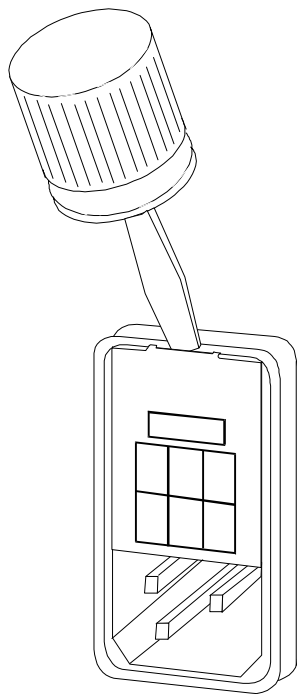
*Note:* If one or both fuses are shattered, this indicates a short circuit in the printer receptacle or in the printer's primary power supply. If a fuse is shattered, do not attempt to replace the fuse; simply unplug the printer and call one of the numbers listed in the front of this operator's guide to obtain qualified servicing.

6. Obtain new fuse(s):
  - For 100 or 120 Vac, use two, 3.00 a., slow-blow fuses (1¼ in. x ¼ in.), rated at 250 v.
  - For 220 or 240 Vac, use two, 1.6 a., time-delay fuses (5 mm x 20 mm), rated at 250 v.

7. Re-insert both fuse holders (with proper fuses) with the arrows facing right, and then re-insert voltage selection tumbler.

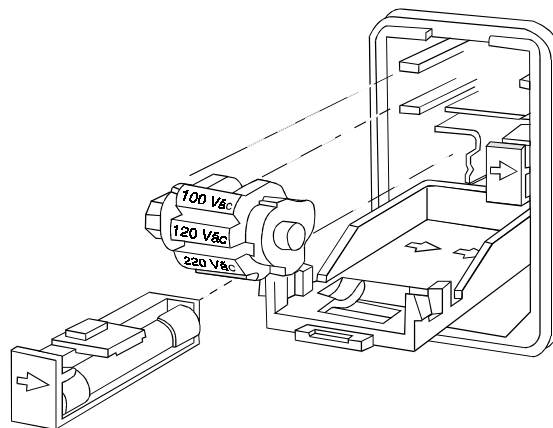
Make sure that the same voltage selection noted in Step 1 faces out through the window of the fuse compartment.

8. Close the compartment.



Opening Fuse Compartment

DA0-E



Changing Fuses

DA0-F

## VERTICAL IMAGE ALIGNMENT

The configuration menu provides a simple means of making slight compensations in the factory's vertical alignment setting.

The printer is a bidirectional printer, meaning it prints text not only on left-to-right passes of the printhead carriage, but also on right-to-left passes. Vertical alignment simply adjusts the relative timing between bidirectional passes so that consecutive lines line up vertically.

Vertical alignment only affects draft text if “Bi-Directional Graphics/NLQ” in the configuration menu is off. If off, graphics, NLQ text, and text printed as graphics, such as TrueType text, are printed only on left-to-right passes of the printhead carriage.

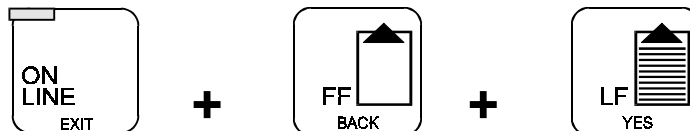
To check or change vertical alignment, proceed as follows:

1. For a wide carriage printer, make sure that wide (14 <sup>7</sup>/<sub>8</sub> in.) paper is installed in the printer.
2. Enter the configuration menu:

If the printer is off, press **FORM FEED** while turning on the printer.



If the printer is on, press and hold **ON LINE** while simultaneously pressing **FORM FEED** and **LINE FEED**.



3. If necessary, check and/or change the Char/Inch setting under PRINT STYLE in the configuration menu.

*Note:* Select a preferred characters-per-inch setting, since vertical alignment varies slightly for different pitches.

4. Select "System Options" in the configuration menu.
5. See the Note below and then select "Vertical Alignment."

*Note:* Vertical alignment must be set at normal print speed.

As a safety feature, when using "fast pitch" (10 pitch printing), the printer prints at half speed if the operator access door is open. To cancel half-speed printing during vertical alignment, press and hold **TOF** while the printer prints out the test patterns.

The printer prints a two-line pattern of vertical lines. The top row of lines should be vertically in line with the bottom row:

### Proper Vertical Alignment



Back or Next to adjust, Yes when done



### Improper Vertical Alignment



Back or Next to adjust, Yes when done



If the top line is too far to the left, as shown above, press **NEXT** to move the top line to the right.

If the top line is too far to the right, then press **BACK** to move the top print line to the left.

The printer prints out the result of the re-alignment.

5. Continue using **BACK** and **NEXT** to align the two lines.
6. When finished with vertical alignment, press **YES** to save the alignment and to proceed to the next configuration menu option.
7. Press **EXIT** twice to leave the configuration menu.



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# Troubleshooting

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## WARNINGS !

- ! Hazardous voltages are present in the 4100 printer. With the enclosure removed and power applied, hazardous voltage areas are present. Equipment service must be performed only by service-trained personnel who are aware of the hazards involved.
- ! Double-Pole/Neutral Fusing. The 4100 printer contains two fuses in the power receptacle. It is possible for only one fuse to blow. If this occurs, be warned that, even though the **POWER** indicator is not lit, some printer electrical circuit may remain active. ALWAYS turn off the printer and unplug the power cord before checking the cause of the blown fuse(s) and before replacing the fuse(s).
- ! Use only the fuses specified. Never use repaired fuses, and never short-circuit a fuse holder.

## TROUBLESHOOTING

Today's computers, printers, and other electronic equipment are, by and large, more reliable than those of just a few years ago. But still troubles occur.

If you have trouble with your printer, *expect the best, not the worst*, because most times the solution to the problem is quite simple.

The following table outlines most minor and major problems along with recommended solutions. If you need additional assistance, though, please call our customer service department—they are more than happy to help. (See the front of this guide for appropriate voice/fax numbers and addresses.) If you call, please have your printer model and serial numbers handy—these numbers are located on the back of the printer.

Use the following questions to begin to identify the problem with the printer:

1. If the printer is not doing anything, is it on line, turned on, plugged in?

If no power, also check fuses (Page 107) and the wall receptacle. If the **POWER** indicator is not lit, see "Switch Panel" (Page 127) in the troubleshooting chart.

2. Is the **ON LINE** indicator lit?

If not, run the power-up sequence test by simply turning off and then turning on the printer. (See "Power-Up Sequence Test," Page 131.) The **ON LINE** indicator flashes if the operator access door is open.

3. Are there any beeps?

If so, see "Beeps" (Page 119).

4. Are there any printed messages?



If so, see "Messages, Printed" (Page 120).

5. Is the interface cable securely connected and is the printer responding to the host computer?

If not, see "Communications" (Page 129).

6. Is the paper and ribbon installed properly?
7. Is the paper path obstructed?
8. Did you change paper, ribbon, configuration settings, computers, ports, print drivers, power receptacles or cords, printhead gap just before the problem occurred?

If so, double-check to be sure the procedure is completed and correct.

9. Any problem with switch panel control of the printer: for example, indicators that do not light, switches that do not seem to work?

If so, see "Switch Panel" (Page 127).

10. Does there seem to be a problem with computer control of the printer. or is the format, print mode, spacing, etc. wrong?

If so, see "Communications" (Page 129).

11. Does the problem manifest itself as a paper problem or a print positioning problem?

For paper problems (jams, positioning, **PAPER** indicator), see "Paper Problems" (Page 124).

For a print positioning problem (not printing in the right place), see "Print Positioning" (Page 123) and "Communications" (Page 129).

12. Have you attempted a self test printout?

To do so, press and hold **LINE FEED** while turning on the printer:

If the print is smudged, faded, broken, and the like, see "Print Quality" (Page 120).

If the printhead carriage moves too slowly or makes noise, see "Printhead Performance" (Page 130).

To stop the printout, press **ON LINE**.

13. Have you attempted to print a status page?

To do so, press and hold **FORM FEED** while turning on the printer.

The printer prints the question "HELP OPTIONS" Press **YES**. The printer then prints "Status Print ?" Again, press **YES**. Check printout for incorrect settings.

## TROUBLESHOOTING CHART

Problem	Probable Cause	Solution
<b>BEEPs</b>		
Four-Second BEEEEEEEEEP With PAPER OUT Lit	1. Paper Out 2. Left Tractor Too Far to Right 3. Bad Paper Out Sensor	1. Install paper (Page 21). 2. Move the left tractor to the far left so that paper covers the paper out sensor. 3. Call for service.
Beep-BEEP-Beep- BEEP-Beep-BEEP (Three High-Low Beeps) With PAPER OUT Flashing	Paper Jam	Clear jam.
Endless BEEP-BEEP- BEEP-BEEP-BEEP etc.*	Long Intermittent String of Bad Serial Data	1. Check printer's "Set Serial Options" in configuration menu against those of host. 2. Check data from host using hex dump mode (Page 132). 3. Call for service.
1 Short followed by 4 Short-Long Beeps: SSSSS SSSSL SSSLS	Recoverable Memory Error:  ROM Checksum Error EEPROM Error Bad ROM	If problem persists, call for service.
5 Long Beeps (LLLLL)	Nonrecoverable Error	Press <b>ON LINE</b> to solicit specific beep patterns, if any. Record beep pattern; see list that follows. Cycle printer off/on to reset.

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\* Turn off printer to stop beeping.

## TROUBLESHOOTING CHART, CONTINUED

Problem	Probable Cause	Solution
<b>BEEPs, continued</b>		
1 Long followed by 4 Short-Long Beeps: LSSSS LSSSL LSSLS LSSLL LSLSS  LSLSL LSLLS LSLLL LLSSS LLSSL LLSLS* LLSLL LLLSL	Nonrecoverable Errors:  Printhead #1 Error Printhead #2 Error Printhead #3 Error Carriage Motor Overcurrent Carriage Motor Driven Overtemperature HV Error 24 vdc** Error 12 vdc Error Tachometer Overrun Error Linefeed Motor Overcurrent Tachometer Timeout Error Processor Error Synthesis Counter Overrun	Record beep pattern. Press <b>ON LINE</b> to solicit still other patterns, if any.  Turn off and then turn on printer to reset. If problem persists, record beep pattern(s) and call for service.
<b>Messages, Printed</b>		
ROM ERROR	Bad Checksum	Press <b>ON LINE</b> . If problem persists, call for service.
NONVOLATILE RAM CHECKSUM - - Setting Default Parameters***	New Checksum Does not Match Previous Checksum	Press <b>ON LINE</b> . If problem persists, call for service.

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\* Will occur if the carriage is impeded by an obstruction.

\*\* Used for dc cooling fan.

\*\*\* The printer returns to factory default setting. This often happens when upgrading firmware.

## TROUBLESHOOTING CHART, CONTINUED

Print Quality		
No Printout	<ol style="list-style-type: none"> <li>1. No Ribbon Cartridge, or Cartridge Not Installed Properly</li> <li>2. Ribbon Twisted</li> </ol>	<ol style="list-style-type: none"> <li>1. Re-install ribbon cartridge (Page 100).</li> <li>2. Check ribbon.</li> </ol>
Characters Too Light	<ol style="list-style-type: none"> <li>1. Printhead Gap Too Wide</li> <li>2. Ribbon Worn Out</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust printhead gap (Page 27).</li> <li>2. Replace ribbon (Page 100).</li> </ol>
Fading Print	<ol style="list-style-type: none"> <li>1. Worn Out Ribbon</li> <li>2. Ribbon Not Advancing, or Motor or Electronics Failure</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace ribbon (Page 100).</li> <li>2. Re-install or replace ribbon (Page 100). If problem persists, call for service.</li> </ol>
Characters are OK, Then Begin to Break Up (Carriage May Hit Bumper)	Electronics Failure	Call for service.
Smudging	<ol style="list-style-type: none"> <li>1. Printheads Too Close to Paper</li> <li>2. Worn Ribbon and/or Ribbon Guides</li> <li>3. Printhead Blend Needs Adjusting</li> </ol>	<ol style="list-style-type: none"> <li>1. Re-adjust printhead gap (Page 27).</li> <li>2. Examine. If necessary, replace ribbon cartridge (Page 100).</li> <li>3. Call for service.</li> </ol>
Bottom Half of Characters Missing	Forms Compressor Not On Alignment Tabs	Check that forms compressor is properly positioned over right and left alignment tabs.

## TROUBLESHOOTING CHART, CONTINUED

<b>Print Quality, continued</b>		
<b>Problem</b>	<b>Probable Cause</b>	<b>Solution</b>
Scanner Will not Read Barcodes	1. Barcode Density Too Low  2. Vertical Misalignment During Bi-Directional Printing  3. Worn Out Ribbon	1. Set density in configuration menu to 100 dpi (Page 91).  2. Re-adjust vertical alignment in configuration menu (Page 93). If necessary, turn off bi-directional printing in configuration menu (Page 73).  3. Replace ribbon (Page 100). Try double strike printing (Page 91).
Scanner Will not Read PostNet Barcodes	1. See "Scanner Will not Read Barcodes" above	
	2. PostNet Mode (text versus graphics)	2. Prefer PostNet text mode. (See Appendix E.)
<b>Italics (Epson Emulation)</b>		
Printout is ALL (or partly) Italics and Should not Be (Both Parallel and Serial Interfaces)	Characters used are from the Upper Half of the Character Set	Use data bytes 32-127 for upright characters and 160-255 for italic characters.
Printout is ALL (or partly) Italics and Should not Be (Serial Interface Only)	Operating Systems Such as UNIX Routinely Use Characters in Upper Half of Character Set	In configuration menu, change the number of data bits in "Serial Options" from 8 to 7 bits.
<b>Print Positioning</b>		
Margin Drift	Belt Too Loose or Motor Failure	Call for service.
Print Shifts Right or Left Until Carriage Hits Bumper	Carriage Belt is Slipping At Belt Clamp	Call for service.
Entire Paragraphs Print Out on One Line	No Line Feeds From Host	In configuration menu, change "LF on CR" from "Off" to "On".

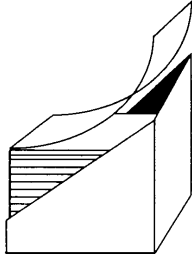
## TROUBLESHOOTING CHART, CONTINUED

Problem	Probable Cause	Solution
<b>Print Positioning, continued</b>		
Blank Lines Between Every Line of Print	Printer and Host Both Supplying Line Feeds	In configuration menu, change "LF on CR" from "On" to "Off".
Prints Across Horizontal Perforation	<ol style="list-style-type: none"> <li>Wrong Configuration Setting</li> <li>Host Changing Forms Settings</li> </ol>	<ol style="list-style-type: none"> <li>In configuration menu, change "Skip Perf" from "Off" to "On".</li> <li>Check print driver settings of host software. If necessary, use hex dump mode (Page 132) to check control codes sent by host.</li> </ol>
Prints Across Left Vertical Perforation	Paper Too Far to the Right	The left tractor should be positioned at the far left stop.
Prints Across Right Vertical Perforation	Normal	Form, column, and margin widths are controlled by the host software. Unformatted text prints a full carriage-width line.*
<b>Paper Problems (Positioning, Feeding, Paper Out, Jamming)</b>		
<b>PAPER</b> Lit (With Paper Installed)	<ol style="list-style-type: none"> <li>Left Tractor Too Far to Right</li> <li>Paper Out Sensor Lever Needs Adjusting</li> <li>Bad Paper Out Sensor or Electronics Failure</li> </ol>	<ol style="list-style-type: none"> <li>Move the left tractor to the far left so that paper covers the paper out sensor.</li> <li>Call for service.</li> <li>Call for service.</li> </ol>
<b>PAPER</b> Flashing	Paper Jam	Clear Jam.

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\* Avoid printing directly on the platen.

## TROUBLESHOOTING CHART, CONTINUED

Problem	Probable Cause	Solution
<b>Paper Problems (Positioning, Feeding, Paper Out, Jamming), continued</b>		
Paper Does not Feed When Printing	Host Not Sending Line Feeds with Carriage Returns	In configuration mode, under "Set Forms Options" set "LF on CR" to "On".
Paper Does not Feed When Using Switch Panel	Switch Panel or Electronics Failure	Call for service.
Paper Does not Feed Reliably  (Frequent Tears, and/or Paper Jams)	<ol style="list-style-type: none"> <li>1. Paper Supply Not Positioned Correctly</li> <li>2. Paper Stretched Too Tight</li> <li>3. Paper hanging up on front of stand or table during front feed.</li> <li>4. Paper Hanging Up on Paper Box</li> <li>5. Paper Too Heavy or Light for Front Feed Path</li> </ol>	<ol style="list-style-type: none"> <li>1. Align paper supply so it is in line with the paper feed tractors.</li> <li>2. Release tension on paper by moving right tractor slightly closer to left tractor.</li> <li>3. Make sure front feed path is unobstructed. Prefer the bottom feed path.</li> <li>4. Trim box (as shown below) or remove paper from box.</li> </ol>  <p style="text-align: right;">AB0-J</p> <ol style="list-style-type: none"> <li>5. Consider using the bottom feed path.</li> </ol>



## TROUBLESHOOTING CHART, CONTINUED

Problem	Probable Cause	Solution
<b>Paper Problems (Positioning, Feeding, Paper Out, Jamming), continued</b>		
Paper Does not Feed (Both On and Off Line)	<ol style="list-style-type: none"> <li>1. Obstruction</li> <li>2. Mechanical or Electronics Failure</li> </ol>	<ol style="list-style-type: none"> <li>1. Check paper path for obstruction.</li> <li>2. Call for service.</li> </ol>
Top of Form Ignored or Paper Slews to Wrong TOF Setting	<ol style="list-style-type: none"> <li>1. Wrong Form Length Setting</li> <li>2. Host Changing Forms Settings</li> <li>3. Electronic Failure</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the "Form Length" setting (Page 77) in the configuration menu.</li> <li>2. Check print driver settings of host software. If necessary, use hex dump mode (Page 132) to check control codes sent by host.</li> <li>3. Call for service.</li> </ol>
<b>Switch Panel</b>		
Self Test or Menu Printout Occurs Without Being Selected	Switch Panel or Electronics Failure	Call for service.
No Response to Keys (Power On, but <b>POWER</b> is Not Lit)	Power Problem	Perform a Power-Up Sequence Test (Page 131).
No Response to Keys ( <b>POWER</b> is Lit)	Switch Panel or Electronics Failure	Call for service.
Paper Does not Feed When Using Switch Panel	Switch Panel or Electronics Failure	Call for service.

## TROUBLESHOOTING CHART, CONTINUED

Problem	Probable Cause	Solution
<b>Communications</b>		
Character or Control Problems With Any Interface	<ol style="list-style-type: none"> <li>1. Printer's Menu Settings Have Been Superseded by Host</li> <li>2. Printer Off or Off line</li> <li>3. Blown Fuse</li> <li>4. Electronics Failure</li> </ol>	<ol style="list-style-type: none"> <li>1. Normal. Host computer commands override printer configuration settings for print style, characters set, and forms control. (These printer configuration settings are only effective until the host changes the settings using printer control commands.)</li> <li>2. Check.</li> <li>3. Replace fuse (Page 107).</li> <li>4. Call for service.</li> </ol>
Problems When Using Serial Interface Only: <ul style="list-style-type: none"> <li>• Garbled text with numerous "?" characters</li> <li>• No printout</li> <li>• Printer prints a few pages and quits</li> </ul>	<ol style="list-style-type: none"> <li>1. Wrong Serial Interface Settings</li> <li>2. Loose or Bad Interface Cable</li> <li>3. Bad Data</li> <li>4. Electronics Failure</li> </ol>	<ol style="list-style-type: none"> <li>1. Host and printer settings for baud, data bits, parity, and stop bits must be the same. Check "Serial Options" (Page 64) in printer's configuration mode.</li> <li>2. Check. If necessary, replace interface cable.</li> <li>3. Check data using hex dump mode (Page 132).</li> <li>4. Call for service.</li> </ol>

## TROUBLESHOOTING CHART, CONTINUED

Problem	Probable Cause	Solution
<b>Communications, continued</b>		
Problems When Using Parallel Interface Only	1. Loose or Bad Interface Cable	1. Check. If necessary, replace interface cable.
	2. Bad Data	2. Check data using hex dump mode (Page 132).
	3. Electronics Failure	3. Call for service.
<b>Printhead Performance*</b>		
Printheads Click!** (Just When Printer is Turned Off)	Printhead Electronics Failure	Call for service.
Carriage Speed Too Slow	1. Obstruction  2. Belt Tension Too Tight or Loose, Bad Carriage Bearing, or Electronics Failure	1. Check for and remove any material impeding carriage.  2. Call for service.
Printhead Snags Ribbon	1. Worn Ribbon 2. Printhead or Electronics Failure	1. Replace ribbon (Page 100). 2. Call for service.

---

\* If accompanied by beeping, see BEEPS.

\*\* The sound of a printhead hammer or hammers striking paper.

## TROUBLESHOOTING AIDS

### POWER-UP SEQUENCE TEST

The normal start-up sequence for the printer is detailed in the following table. The printer performs this sequence each time the printer is turned on.

<b>After Turning On Printer, Observe the Following:</b>	<b>Meaning That :</b>	<b>If Not Observed :</b>
A. Indicators light briefly. <b>POWER</b> indicator remains on.	Power is applied to printer. Main power supply is operating OK and feeding power to switch panel.	Check power receptacle, power cable, and printer fuses (Page 107). If necessary, call for service.
B. Printhead carriage moves right to left, then stops at extreme left.	Carriage motor functions properly. While tracking, the printer checks position of the printhead carriage and then parks the carriage at its "home" position in preparation for printing.	Check for an obstruction. If necessary, call for service.

## POWER-UP SEQUENCE TEST, CONTINUED

After Turning On Printer, Observe the Following:	Meaning That :	If Not Observed :
C. Printer chirps.	Printer is mechanically and electronically OK. (A manual off line/on line cycle also causes this chirp.)	Call for service.
D. <b>ON LINE</b> indicator lights.	Printer is ready for operation.	If <b>ON LINE</b> does not light, check for paper out, paper jam, printhead carriage obstruction. If it flashes, close the operator access door. If necessary, call for service.

## HEX DUMP MODE

The hexadecimal (hex) dump mode is used for checking:

- Proper receipt of characters by the printer
- Control commands
- Nonprintable codes

To enter the hex dump mode, do one of the following:

- Press and hold **LINE FEED** and **FORM FEED** and then turn on printer to place printer in 10 pitch hex dump mode.

The printer prints all transmissions from the host in hex dump format on 13.6-in. lines.

- Press and hold **ON LINE**, **LINE FEED**, and **FORM FEED** and then turn on printer to place printer in 17.14 pitch hex dump mode.

The printer prints all transmissions from the host in hex dump format on 8-in. lines.

A hex dump shows both the hexadecimal value of all characters received by the printer and, where possible, also prints the character itself in the right-hand column. (See the example.) Unprintable characters are represented as a period (.).

To exit the hex dump mode, turn off printer.

54 68 65 20	67 68 20 76 6F 6C 75 6D 65 2C 20 68 69	The printer is a high-volume, hi
67 68 20 77	5 73 20 66 6F 72 6D 20 70 72 69 6E 74 65	gh-speed, continuous-form printe
72 20 66	74 69 63 61 6C 20 61 70 70 6C 69 63 61 74	r for business critical applicat
69 6F 6E	70 61 74 65 6E 74 65 64 20 54 72 69 6D 61	ions. Its unique patented Trima
74 72 69	6 73 75 72 65 73 20 73 6F 6C 69 64 20 70 65	trix technology assures solid pe
72 66 6	8 2D 71 75 61 6C 69 74 79 20 6F 75 74 70 75	rformance and high-quality outpu
74 2E	20 64 65 6C 69 76 65 72 73 20 33 30 30 20 6C	t.....The printer delivers 300 l
69 6E	6E 20 74 68 65 20 77 69 64 65 2D 63 61 72 72	ines per minute in the wide-carr
69 67	4 30 30 20 6C 70 6D 20 69 6E 20 74 68 65 20 6E	iage model, and 400 lpm in the n

Hex Dump Mode Printout (Example)

JB0-AL

---

# Control Commands

## An Introduction

---

This section explains the following:

- Communication basics
- Sending control codes and control commands
- Identifying data bytes
- Typographic conventions

### COMMUNICATION BASICS

Communication between the computer and printer is accomplished by exchanging codes that have a predefined meaning. The building blocks of these codes are bits and bytes.

Bits are the fundamental element of computer communication and may have one of two values: zero and one. Computers and printers recognize only these two states: zero and one.

A byte, or data byte, is a group of 8 bits that have significance as a unit.

There are 256 possible patterns of zeros and ones in an 8-bit data byte, so there are 256 unique data bytes. Individual data bytes are identified by a number related to the pattern of zeros and ones.

There are different conventions for assigning meaning to individual data bytes. In the 4100 printer, two different conventions are used:

- In Epson and IBM Proprinter XL emulations, the American Standard Code for Information Interchange (ASCII) is used.
- In DEC emulations, American National Standards Institute (ANSI) standards are used.

Aspects of these standards relevant to the emulations contained in the 4100 printer are described in this section.

## IDENTIFYING DATA BYTES

Individual data bytes can be identified using one of several number systems. This section describes three number systems in common use:

- Binary
- Decimal
- Hexadecimal

Three number systems are used because each has advantages in specific situations. Some understanding of these number systems is beneficial when working with printers.



## **BINARY NUMBER SYSTEM**

Computers use the binary number system. In the binary (base two) number system, we count from zero (0) to one (1) and then start over again. All other numbers are expressed using only these two digits.

The pattern of zeros and ones in a data byte can be interpreted as a binary number. The bit pattern 00001110 can be interpreted as itself, as the binary number 00001110. Thus, each data byte can be numbered uniquely for a total of 256 unique bytes.

The number, or value, of the data byte can also be expressed in other number systems, including the decimal and hexadecimal systems.

## **DECIMAL NUMBER SYSTEM**

The decimal number system is the most common number system. In the decimal (base ten) number system, counts from zero (0) to nine (9) and then starts over again. All other numbers are expressed using these ten digits. The 256 unique data bytes in the binary system can also be identified with decimal numbers. For example, the data byte with pattern 00001110 can be identified by binary number 00001110 and by decimal number 14. Both numbers identify the same data byte.

The decimal number system is used in this manual to identify data bytes unless explicitly stated otherwise.

## HEXADECIMAL NUMBER SYSTEM

The hexadecimal (hex) number system is used in the computer industry because its relationship to the binary number system allows convenient notation. In the hexadecimal (base sixteen) number system, counts from zero (0) to fifteen (15) and then starts over again. The sixteen digits are represented by the numbers zero (0) through nine (9) and the letters A through F. All other numbers are represented using these sixteen characters.

The 256 unique data bytes in the binary system can be identified with either decimal or hexadecimal numbers. For example, the data byte with pattern 00001110 can be identified by decimal number 14, or equally well, by hexadecimal number 0E.

The table below shows equivalent binary, decimal, and hexadecimal numbers for 17 different data bytes.

Binary Number	Decimal Number	Hexadecimal Number
00000000	0	00
00000001	1	01
00000010	2	02
00000011	3	03
00000100	4	04
00000101	5	05
00000110	6	06
00000111	7	07
00001000	8	08
00001001	9	09
00001010	10	0A
00001011	11	0B
00001100	12	0C
00001101	13	0D
00001110	14	0E
00001111	15	0F
00010000	16	10

A chart at the end of the Operations section shows corresponding decimal and hexadecimal numbers for all 256 possible data bytes.

## THREE CATEGORIES OF DATA BYTES

The printer takes specific action for each data byte received. Two types of action are possible: A character is printed or a controlling operation is performed. All data bytes are classified into three categories:

- Printable characters
- Control codes
- Elements in a control sequence or command

Each category is described in the following paragraphs.

### Printable Characters

Characters are printable symbols: Letters, numbers, punctuation marks, graphic shapes, and all other symbols that can be printed as a unit within a single cell. A blank space is also a valid character.

### Control Codes

A control code is a single byte of control information that modifies printer action. It commands the printer to change something. For example, a control code sent to the printer might advance the paper to the top of the next page or it might sound the beeper.

Control codes are assigned to data bytes according to the emulation active in the printer. Specific assignments are shown in Appendix D. The majority of the control codes are normally assigned to data bytes between 0 and 31 decimal and between 128 and 159 decimal.

## **Control Commands**

A control command is two or more bytes of control information. The first data byte is the control code that signals the printer to interpret succeeding data bytes as control information instead of printable characters or other control codes. In Epson, IBM, and DEC emulations, this control code is ESC, data byte 27 decimal. Control commands that begin with ESC are commonly known as escape sequences.

The control code used to introduce the universal control commands (in the next section) is SOH, data byte 1 decimal.

Control commands are defined by printer manufacturers to provide more control options than those contained in ASCII or ANSI standards.

Control codes and control commands may be embedded anywhere in the data stream.

## **SENDING CONTROL CODES AND CONTROL COMMANDS**

You can send commands to the printer with any programming language. Techniques vary with the hardware and software used. In many cases, it is done automatically by the application program. Several examples are shown here for illustration.

## USING BASIC TO SEND COMMANDS

Using BASIC, the control sequence to set the top margin to line 6 in DEC emulation can be sent with the following program:

ASCII sequence:	ESC	[	6	r	
Control sequence in decimal:	27	91	54	114	
BASIC program:	LPRINT CHR\$(27);"[6r";				

To set the left margin to Column 6 and the right margin to Column 76 in IBM Proprinter XL emulation, the following program could be used:

ASCII sequence:	ESC	X	♠	L	
Control sequence in decimal:	27	88	6	76	
BASIC program:	LPRINT CHR\$(27);"X";CHR\$(6);CHR\$(76);				

## USING BATCH FILES TO SEND COMMANDS

If you are running DOS on your computer, you can create batch files to send the necessary data stream to the printer. For example, to select 12-pitch, single-strike printing in Epson emulation, the control command is ESC ! (1). (The parentheses around "1" identify this as parameter 1, which in the Epson emulation is decimal or hexadecimal 1—not the ASCII character 1, which would be decimal 49 or hexadecimal 31.) In this example, we make use of the fact that, in Epson and IBM #1 character sets, data byte value 155 is also the ESC control code. Create a batch file by typing the following at the DOS prompt:

```
COPY CON 12PITCH.BAT
ECHO  !^A > PRN
^Z
```

- The first line tells the computer to copy the lines that follow into the file named "12PITCH.BAT". The ".BAT" extension identifies the file as a batch file.

- The second line is the command that is performed whenever you use this batch file. Enter Ç by pressing the ALT key and entering 155 from the numeric keypad on the right side of the keyboard. Data byte value 155 is also an ESC control code in Epson and IBM #1 character sets.
- Enter ! by typing !. Enter ^A by pressing the ALT key and entering "1" from the numeric keypad. Data byte value 01 decimal is represented by an ^A on the screen, or occasionally by the smiley face.
- The third line closes the file, saving it as named in Line 1. Enter ^Z by pressing the CTRL key and entering Z from the keyboard or by pressing function key F6.

Once the batch file is created, type the name of the file when you want to send the control command to select 12 pitch to the printer. Type the following at the DOS prompt:

```
12PITCH
```

The same command can be sent using the following BASIC program:

ASCII sequence:   ESC ! <smiley face>

BASIC program:   LPRINT CHR\$(27);"!";CHR\$(1);

or,

BASIC program:   LPRINT CHR\$(&H1B);CHR\$(&H21);CHR\$(&H01);

where the prefix &H is used to denote hexadecimal numbers.

## SENDING COMMANDS FROM THE DOS COMMAND LINE

Commands can also be issued directly from the DOS command line by typing the following:

ECHO (*command data*) > PRN

The command to select 12-pitch, single-strike printing in Epson emulation could be sent from the DOS command line as follows:

ASCII sequence:   ESC ! <smiley face>

Command line:           ECHO ø!^A > PRN

## USING CONTROL KEY SEQUENCES TO SEND COMMANDS

Commands composed of a single control code may be sent using a control key sequence corresponding to the assigned data byte.

Where control key sequence formats are shown in this manual, CTRL represents the control key on the computer keyboard, not individual characters to be typed. Control key sequences (for example, CTRL A) are sent by pressing the control key (CTRL) together with the key for the specified character. If CTRL does not appear before a character within the sequence, the key for that character is pressed alone.

The table below shows ASCII control codes assigned to data bytes 0 through 31 (decimal) and the corresponding control key sequence.



Decimal Value	Hexadecimal Value	ASCII Name	Control Key Sequence
0	00	NUL	CTRL @
1	01	SOH	CTRL A
2	02	STX	CTRL B
3	03	ETX	CTRL C
4	04	EOT	CTRL D
5	05	ENQ	CTRL E
6	06	ACK	CTRL F
7	07	BEL	CTRL G
8	08	BS	CTRL H
9	09	HT	CTRL I
10	0A	LF	CTRL J
11	0B	VT	CTRL K
12	0C	FF	CTRL L
13	0D	CR	CTRL M
14	0E	SO	CTRL N
15	0F	SI	CTRL O
16	10	DLE	CTRL P
17	11	DC1	CTRL Q
18	12	DC2	CTRL R
19	13	DC3	CTRL S
20	14	DC4	CTRL T
21	15	NAK	CTRL U
22	16	SYN	CTRL V
23	17	ETB	CTRL W
24	18	CAN	CTRL X
25	19	EM	CTRL Y
26	1A	SUB	CTRL Z
27	1B	ESC	CTRL [
28	1C	FS	CTRL \
29	1D	GS	CTRL ]
30	1E	RS	CTRL ^
31	1F	US	CTRL _

## TYPOGRAPHIC CONVENTIONS

This subsection describes the typographic conventions used in descriptions of control codes and control commands throughout this manual.

### FORMAT

Spaces are never sent to the printer as part of the command. For readability, the arguments of the command are shown separated by spaces.

Character case is significant. For example, if R is shown as part of the command, an uppercase R must be sent.

The format for entering each control code or control command is shown as follows:

*ASCII:* the sequence in ASCII character

*Control:* the sequence in control characters

*Decimal:* the sequence in decimal data bytes

*Hexadecimal:* the sequence in hexadecimal data bytes

All four command formats are equivalent.

## PARAMETERS

Parameters are indicated with the following notations:

- (n), (n1), (n2), etc. and (d),(d1),(d2), etc. The printer expects to receive a data byte for each parameter.

The parentheses are not sent, only the value of parameter n or d. For example, if n=1 in Epson, IBM, or most universal control commands, then a decimal value of 1, *not* the ASCII character 1, is sent to the printer. On the other hand, in DEC control commands, n=1 is the value of ASCII character 1 (decimal 49). In some universal control commands, you can specify n=1 as either decimal 1 or as the ASCII character 1.

- (n1)...(n10): The printer expects to receive from one to ten specific parameters.
- (n1) + (n2 x 256): Because the printer does not use decimal numbers larger than 255, some commands use two bytes of data (n1 and n2) to specify one value. Both n1 and n2 must be in the range 0 to 255.

Two data bytes must be supplied even if only one is needed. If a value less than 256 is needed, n1 is the number itself and n2 is 0. For values equal to or greater than 256, divide the total number needed by 256. n2 is the number of complete groups of 256, and n1 is the remainder.

If you are using a programming language with MOD (modulus) and INT (integer) functions, you can use the following formulas, in which *n* is the total number needed:

$$n1 = n \text{ MOD } 256$$

$$n2 = \text{INT} (n/256)$$

This formula for determining n1 and n2 is used for graphics commands and for specifying a range of characters in some commands (such as the commands to map or download characters).

## DATA BYTE VALUES OF COMMAND PARAMETERS

A source of confusion arises because three of the conventions used to specify command parameters use numbers. For example, 48 could be a decimal data byte, a hexadecimal data byte, or an ASCII character representation of a two-byte sequence, 4 followed by 8. The conventions used in the emulations of the 4100 printer are specified in the following paragraphs.

### Universal, Epson, and IBM Control Commands

Universal, Epson, and IBM control commands use (n) to indicate the decimal value of a single data byte. For example "(n) = (75)" is the data byte identified by decimal number 75. This is the same data byte identified by hexadecimal number 4B and ASCII character K.

### DEC Control Commands

DEC control commands use (n) to indicate an ASCII character or sequence of ASCII characters. For example, "(n)=(75)=(7)(5)=7 5" is a two-byte sequence. The decimal numbers are 55 and 53, and the ASCII characters are 7 and 5.

## ZEROS AND ONES

Since upper case "O's" and zeroes look similar, zeroes in control commands are shown with slashes.

Since lower case els (l) and ones look similar, lower case els in control commands are shown as scripted els ( *ℓ* ).

---

# Universal Control Commands

---

This section describes control commands that are unique to the printer. Universal control commands can be used in any emulation mode.

Before using these commands, read the previous section (Control Commands—An Introduction). It describes the typographic conventions used in this section and contains other information needed to send universal control commands in the correct format.

All universal control commands must begin with the sequence SOH Az or the sequence ESC Az. SOH Az provides maximum compatibility with other printer models and is the sequence documented in this manual.

*Note:* Control command SOH AzP and control commands that begin with the sequence SOH AzZ are reserved for internal use within the printer. Character sequences that begin with these strings causes unpredictable action.

Universal control commands for formatting and printing bar codes are shown for reference in this section. See Appendix E for complete information.

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### *Emulation Mode*

Select Emulation and Reset Printer	SOH A z A (n)	153
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### *Miscellaneous*

n/144 Inch Line Spacing	SOH A z Y (n)	154
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Reset to Power Up Settings	SOH A z X (Ø)	154
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### *Print Style*

Set Pitch and Strike	SOH A z ! (n)	155
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Select Print Quality	SOH A z T (n)	157
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### *Barcodes*

Enable/Disable Barcode Printing	SOH A z L (n)	157
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Set Barcode Parameters	SOH A z M (P1)...(P8)	157
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### *Mapping Characters*

Select Character Source/Library	SOH A z % (s)(l)(n1)(n2)	162
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Map Characters	SOH A z B (n1)(n2)(c1 <sub>a</sub> )(c1 <sub>b</sub> )...(cx <sub>a</sub> )(cx <sub>b</sub> )	163
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**Download Characters**

Download Characters      SOH A z & (m)(n1)(n2)(a1<sub>a</sub>)(a1<sub>b</sub>)(c1)...(cx) 174

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*Graphics*

Universal Graphics              SOH A z \* (d1)(d2)(r)(c1)(c2)(g1)...(gx) 184

## ALPHABETICAL SUMMARY OF UNIVERSAL CONTROL COMMANDS

Command	Function	Page
SOH A z !	Set Pitch and Strike	155
SOH A z %	Select Character Source/Library	162
SOH A z &	Download Characters	174
SOH A z *	Universal Graphics	184
SOH A z A	Select Emulation and Reset Printer	153
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SOH A z C	Length of Form in Millimeters	152
SOH A z L	Enable/Disable Barcode Printing	157
SOH A z M	Set Barcode Parameters	157
SOH A z T	Select Print Quality	157
SOH A z X	Reset to Power Up Settings	154
SOH A z Y	Set n/144 Inch Line Spacing	154

## FORM LENGTH

SOH A z C					Length of Form in Millimeters
<i>ASCII:</i>	SOH	A	z	C	(n)
<i>Control:</i>	CTRL A	A	z	C	(n)
<i>Decimal:</i>	1	65	122	67	(n)
<i>Hexadecimal:</i>	01	41	7A	43	(n)

Sets the form length to a specified number of millimeters. n\* indicates form length as follows:

- n = 0: Form length set to 148.5 mm
- n = 1: Form length set to 210.0 mm
- n = 2: Form length set to 297.0 mm
- n = 3: Form length set to 420.0 mm

If the bottom margin was previously set by the Epson or IBM Skip Over Perforation command, ESC N, the command SOH AzC cancels the bottom margin setting. Therefore, to re-establish the bottom margin after this command is set, send another Skip Over Perforation command. SOH AzC does not cancel Skip Perforation set in the configuration menu. When the printer receives this command, the current form position becomes the top of form.

---

\* (n) can be, for example, decimal 1 or ASCII character 1.



## EMULATION MODE

SOH A z A					Select Emulation and Reset Printer
ASCII:	SOH	A	z	A	(n)
Control:	CTRL A	A	z	A	(n)
Decimal:	1	65	122	65	(n)
Hexadecimal:	01	41	7A	41	(n)

Selects the printer emulation mode and the character set that has been selected from the configuration menu for the selected emulation. n\* specifies the emulation as follows:

- n = 0: Epson FX-100 emulation
- n = 1: IBM Proprinter XL emulation
- n = 3: DEC LA210 emulation

This command also initializes the printer. It initiates the same process as turning the printer on. The printer functions as specified by the configuration menu.

---

\* (n) can be, for example, decimal 1 or ASCII character 1.

## MISCELLANEOUS

SOH A z Y					n/144 Inch Line Spacing
<i>ASCII:</i>	SOH	A	z	Y	(n)
<i>Control:</i>	CTRL A	A	z	Y	(n)
<i>Decimal:</i>	1	65	122	89	(n)
<i>Hexadecimal:</i>	01	41	7A	59	(n)

Sets line spacing to n/144 in. The valid range for n is from 0 to 170. Changing the line spacing affects the amount of space between lines, not the height of the characters.

SOH A z X					Reset to Power Up Settings
<i>ASCII:</i>	SOH	A	z	X	(Ø)*
<i>Control:</i>	CTRL A	A	z	X	(Ø)
<i>Decimal:</i>	1	65	122	88	48
<i>Hexadecimal:</i>	01	41	7A	58	30

Resets the printer to power-up default settings. The printer functions as specified in the configuration menu. To reset the printer to factory default settings, use the configuration menu.

---

\* (Ø) can be decimal 0 or ASCII character Ø.

## PRINT STYLE

SOH A z !						Set Pitch and Strike
<i>ASCII:</i>	SOH	A	z	!	(n)	
<i>Control:</i>	CTRL A	A	z	!	(n)	
<i>Decimal:</i>	1	65	122	33	(n)	
<i>Hexadecimal:</i>	01	41	7A	21	(n)	

Specifies the number of characters per inch (pitch) and degree of boldness (strike).

Binary values for n are as follows:

<b>Bit</b>	<b>Setting</b>
7:	16.67 pitch
6:	Ignored
5:	0 = disable enlarged (double wide) printing 1 = enable enlarged (double wide) printing
4:	0 = disable double strike printing 1 = enable double strike printing
3:	0 = disable emphasized (bold strike) printing 1 = enable emphasized (bold strike) printing
2-0:	Specifies pitch (other than 16.67) as follows:
	000 = 10 pitch
	001 = 12 pitch
	010 = 15 pitch
	011 = 12 pitch
	100 = 17.14 pitch
	101 = 18.2 pitch
	110 = 18.2 pitch
	111 = 18.2 pitch

Decimal values for n are shown on the next page.

Decimal values for n are as follows:

Pitch	Single	Double	Bold	Extra
-------	--------	--------	------	-------

				<b>Bold</b>
18.2	5,6,7	21,22,23	13,14,15	29,30,31
17.14	4	50	12	28
16.67	128	144	136	152
15.0	2	18	10	26
12.0	1,3	17,19	9,11	25,27
10.0	0	16	8	24
9.1	37,38,39	53,54,55	45,46,47	61,62,63
8.57	36	52	44	60
8.33	160	176	168	184
7.5	34	50	42	58
6.0	33,35	49,51	41,43	57,59
5.0	32	48	40	56

*Note:* Parameter value 13 (decimal) may not be successfully transmitted to the printer if sent using BASIC programming language.  
Parameter value 26 (decimal) may not be successfully transmitted to the printer if sent using C programming language.

SOH A z T					Select Print Quality
<i>ASCII:</i>	SOH	A	z	T	(n)
<i>Control:</i>	CTRL A	A	z	T	(n)
<i>Decimal:</i>	1	65	122	84	(n)
<i>Hexadecimal:</i>	01	41	7A	54	(n)

Selects draft or near letter quality (NLQ) printing. n\* specifies the print quality as follows:

- n = 0: draft
- n = 2: NLQ

*Note:* Near letter quality printing is available only in 10, 12, and 15 pitch.

## BARCODES

SOH A z L					Enable/Disable Barcode Printing
<i>ASCII:</i>	SOH	A	z	L	(n)
<i>Control:</i>	CTRL A	A	z	L	(n)
<i>Decimal:</i>	1	65	122	76	(n)
<i>Hexadecimal:</i>	01	41	7A	4C	(n)

Enables or disables the printing of barcode symbols. For complete information on printing barcodes see Appendix E.

SOH A z M					Set Barcode Parameters
<i>ASCII:</i>	SOH	A	z	M	(P1)...(P8)
<i>Control:</i>	CTRL A	A	z	M	(P1)...(P8)
<i>Decimal:</i>	1	65	122	77	(P1)...(P8)
<i>Hexadecimal:</i>		01	41	7A	4D (P1)...(P8)

Specifies the parameters used to print barcodes. The function of each parameter is explained in Appendix E.

---

\* (n) can be, for example, decimal 2 or ASCII character 2.

## MAPPING CHARACTERS

The commands in this subsection enable you to map a printable character to each data byte value between 0 and 255, to select a character from ROM (permanent memory), or to download and select a character from RAM (temporary memory).

Mapping a character to a data byte value re-assigns the action the printer takes when it receives a data byte with that value.

For example, if you map the letter "A" to data byte value 33, normally associated with the exclamation mark, "!", then each time the printer receives that data byte value, an "A" is printed.

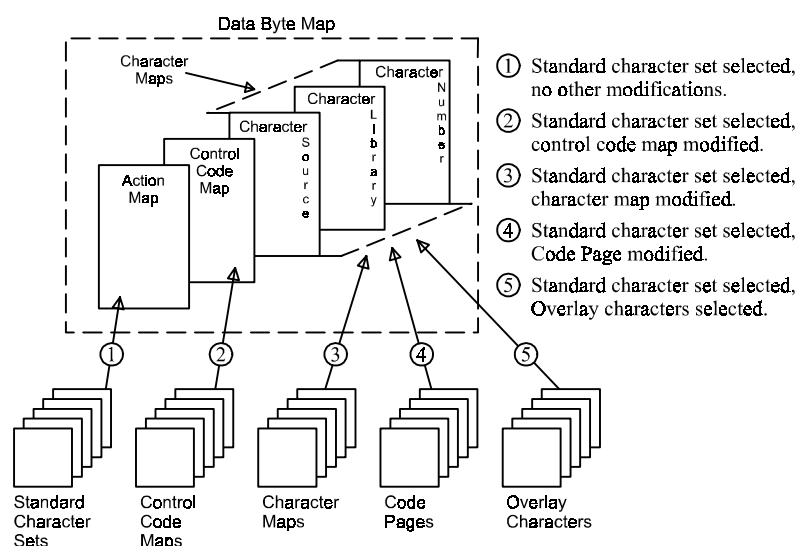
*Note:* Remapping characters does not affect their use in control commands.

Current settings for all data byte values are stored in the data byte map. The data byte map is a group of five maps in printer memory that describe the action the printer performs when it receives a data byte. These maps are described below:

<b>Data Byte Action Map</b>	Describes whether each data byte value between 0 and 255 is interpreted as a control code or a printable character.
<b>Control Code Map</b>	Describes the control codes currently assigned to data byte values between 0 and 255.

<b>Character Source Map</b>	Describes the location of the selected character library: ROM or RAM. Character sets and character maps selected from the configuration menu are stored in ROM. Mapped characters originate in ROM, so their source is ROM. Download characters are downloaded directly to RAM, so their source is RAM.
<b>Character Library Map</b>	A character library is a defined group of printable characters stored in the printer. This map shows which library is currently active for each data byte value between 0 and 255.
<b>Character Number Map</b>	Each character in a character library is numbered. The character number map specifies which characters are currently selected for each data byte value between 0 and 255.

The 4100 printer emulates several printers, each of which has defined "standard" character sets, control code maps, and national-use character maps. Examples are Epson-German-ESC 6 and IBM #2-Code Page 437. Selecting these standard options can be done using the configuration menu or control commands described in other sections. Selecting these options modifies the data byte map as illustrated below.



### Modifying the Data Byte Map, Standard Character Options

ABO-N1

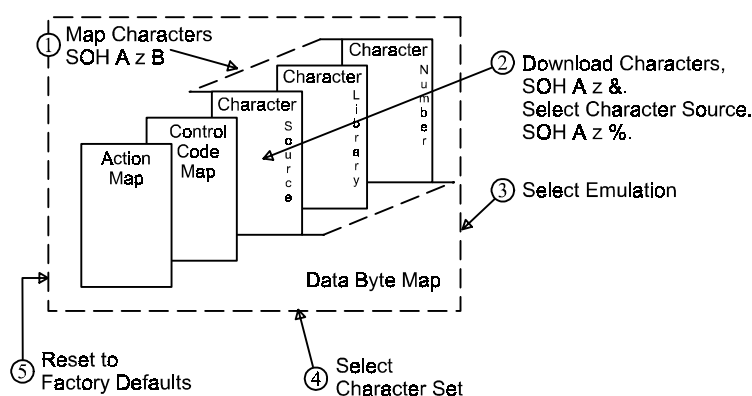
The data byte map is also updated each time you perform one or all of these actions:

1. Map various printable characters from the character library to a range of data byte values.
2. Download some characters you design to RAM (temporary memory) and select some of the download characters to print by changing the character source to RAM.
3. Select a new emulation mode, overwriting any mapped characters and control codes but not the download characters.



4. Select a new character set, overwriting any mapped characters and control codes but not the download characters.
5. Reset the printer to factory defaults, overwriting all prior selections.

See the illustration below.



### Modifying the Data Byte Map, Additional Options

AB0-O

At any time, you can see the characters and control codes currently assigned to each data byte value. Use the configuration menu to print a data byte map.

Character set, character map, and emulation settings should be made before mapping characters. Download characters cannot be remapped.

Mapped characters remain in effect until:

- Cleared with the "Factory Reset" option on the configuration menu or control command SOH AzX

- Overwritten by new selections
- A new emulation or character set is selected
- Power is turned off

The format and examples for sending the command follows.

SOH A z %					Select Character Source and Library			
<i>ASCII:</i>	SOH	A	z	%	(s)	(l)	(n1)	(n2)
<i>Decimal:</i>	1	65	122	37	(s)	(l)	(n1)	(n2)
<i>Hexadecimal:</i>	01	41	7A	25	(s)	(l)	(n1)	(n2)
<i>Control:</i>	CTRL A	A	z	%	(s)	(l)	(n1)	(n2)

Selects a character source and character library for a range of data bytes. s specifies the source—the type of memory that contains the character library. • specifies the character library residing in the character source. Values for s and • are as follows:

		Character	Character
s	•	Source	Library
0	0	ROM (permanent memory)	Currently selected
character set			
1	0	RAM (temporary memory)	Download characters
2	0	ROM	OCR-A overlay characters
2	1	ROM	OCR-B overlay characters

n1 and n2 define the range of data bytes for which the selection applies. To map only one data byte, enter the same value for both n1 and n2.

OCR-A and OCR-B characters print only when NLQ printing is selected. (See Appendix D for charts of OCR-A and OCR-B characters.) The characters correspond to the characters in the current data byte map. If you have mapped characters prior to selecting OCR-A and OCR-B, the overlay characters equivalent to the mapped characters are printed. If no equivalent to a mapped character exists within the OCR-A or OCR-B

character library, the character for that data byte value is printed from the default character set for the currently selected emulation.

Character source and library selections are stored until power off, printer reset, or until changed using this command, control sequence SOH Az&, or the "Overlay Characters" option in the configuration menu.

SOH A z B						Map Characters	
ASCII:	SOH	A	z	B	(n1)	(n2)	(c1 <sub>a</sub> )(c1 <sub>b</sub> )...(cx <sub>a</sub> )(cx <sub>b</sub> )
Control:	CTRL A	A	z	B	(n1)	(n2)	(c1 <sub>a</sub> )(c1 <sub>b</sub> )...(cx <sub>a</sub> )(cx <sub>b</sub> )
Decimal:	1	65	122	66	(n1)	(n2)	(c1 <sub>a</sub> )(c1 <sub>b</sub> )...(cx <sub>a</sub> )(cx <sub>b</sub> )
Hexadecimal:	01	41	7A	42	(n1)	(n2)	(c1 <sub>a</sub> )(c1 <sub>b</sub> )...(cx <sub>a</sub> )(cx <sub>b</sub> )

This controls the relationship between data byte values and their associated printable characters. Any printable character from the current character source and character library may be mapped to any data byte value between 0 and 255, enabling you to create custom character maps.

n1 and n2 define the range of data byte values to which the characters are mapped. To map a single character, enter the same data byte value for both n1 and n2.

The number of each character to be mapped to the range of data byte values is specified using two bytes: c<sub>a</sub> is the least significant byte of the character number, c<sub>b</sub> is the most significant byte of the character number. *c<sub>a</sub> and c<sub>b</sub> must be specified for each character in the range n1 through n2.*

This control command only maps characters from the currently selected character source and character library. Character source and character library are selected with command SOH Az%. Download characters cannot be remapped.

Maps created using this command are stored until power off, printer reset, or until overwritten by other selections. Selecting a character set or changing emulation mode overwrites current selections.

See Appendix D for charts of standard character sets and the character library.

*Example*

```
REM REMAP CHARACTERS G THROUGH K TO DATA BYTE VALUES
REM ASSOCIATED WITH CHARACTERS A THROUGH E
LPRINT CHR$(1);"AzBGK";CHR$(65);CHR$(0);CHR$(66);CHR$(0);
LPRINT CHR$(67);CHR$(0);CHR$(68);CHR$(0);CHR$(69);CHR$(0);
LPRINT "ABCDEFGHJK"
RESULT: "ABCDEFABCDE"
```

## DOWNLOAD CHARACTERS

Using the download character command, SOH Az&, you can design special symbols or graphic patterns or create a custom alphabet. The following pages describe how to:

- Define and download characters of your own design
- Store the characters
- Select and accept the characters for printing

When you *map* a character, as shown earlier, you re-assign a printable character that is stored in the printer to a data byte value between 0 and 255. The printer supplies the character data—the shape, size, and style of the character, as well as the intercharacter space.

When you *download* a character, you supply the character data as well as map it to a specific data byte value. You are not limited to characters within the printer's character library. You can create whatever printable shape you want. If "Input Buffer Size" is set to "Minimum," you can download up to 128 different characters. Download characters cannot be remapped.

# DESIGNING DOWNLOAD CHARACTERS

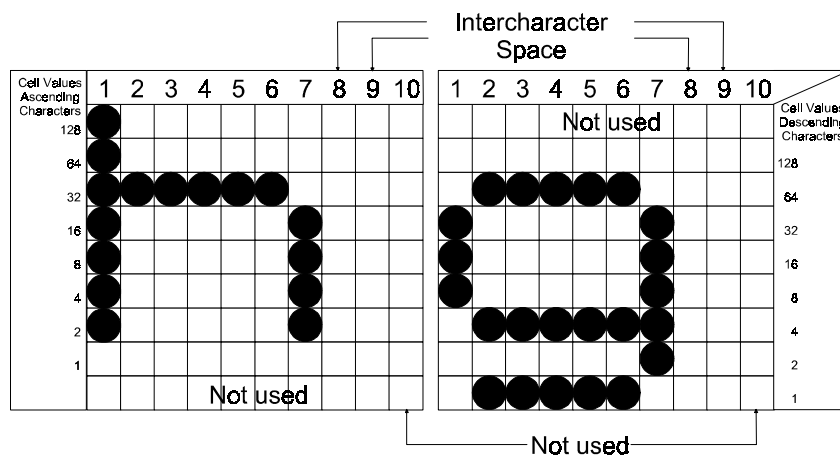
Design the character within a matrix of 10 dot columns by 9 dot rows, like the one shown below. Column 10 is always blank.

Cell Values Ascending Characters	1	2	3	4	5	6	7	8	9	10	Cell Values Descending Characters
128											128
64											64
32											32
16											16
8											8
4											4
2											2
1											1

Character Design Matrix

The cell values are used to tell the printer which printhead pins fire to create the character. The cell value for each column is a binary value that corresponds to the printhead pins used to print the dots in that row.

Eight of the nine printhead pins are used to print the character. Characters that ascend above the character waistline (such as h, t, A, M) are printed by the top eight pins. Use the top eight rows on the matrix to design ascending characters. Characters that descend below the baseline (such as p, g, y) are printed by the lower eight pins. Use the bottom eight rows on the matrix to design descending characters. Using cell values to calculate character data is shown later in this section.

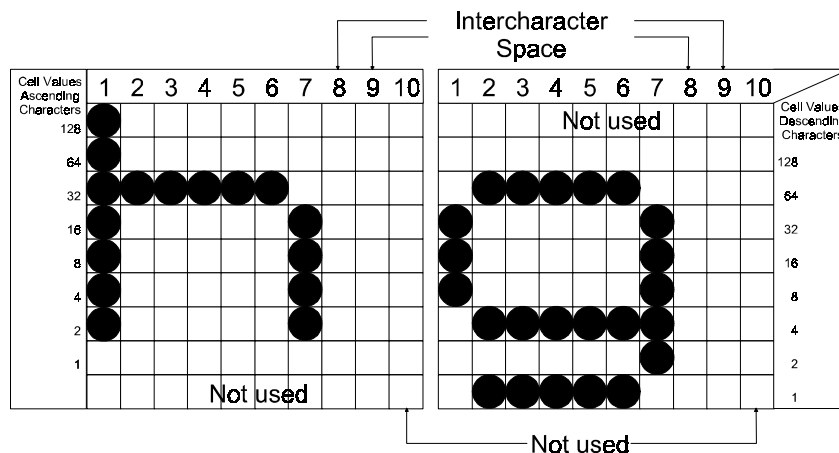


## Designing Ascending and Descending Characters

## EXTENDED CHARACTERS

Use a matrix like the one shown below to design shaded characters, like those typically assigned to data byte values 176 to 178 and 219 to 223 decimal, and line drawing characters, like those typically assigned to data byte values 179 to 218 decimal.

If a line draw character is selected, the dots you enter in Row 8 are copied into Rows 10, 11, and 12. If a shaded character is selected, the dots you enter in Rows 6, 7, and 8 are copied into Rows 10, 11, and 12.



### Extended Characters

AB0-T1

*Note:* Print shaded characters and line drawing characters at 6 lpi line spacing to obtain the full effect of the extension.

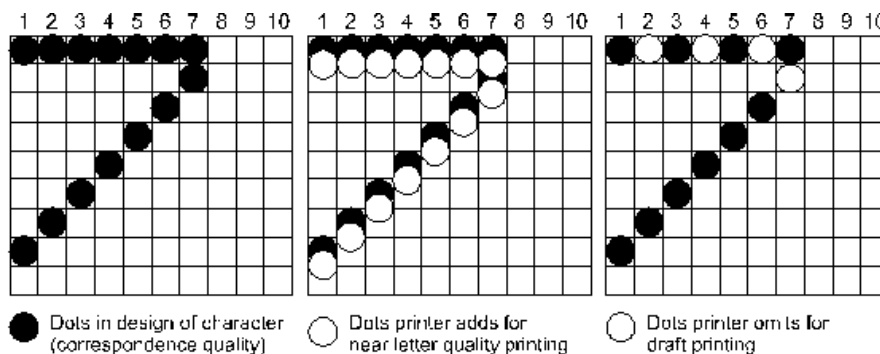


## PRINT QUALITY

There are two ways to define the print quality of downloaded characters:

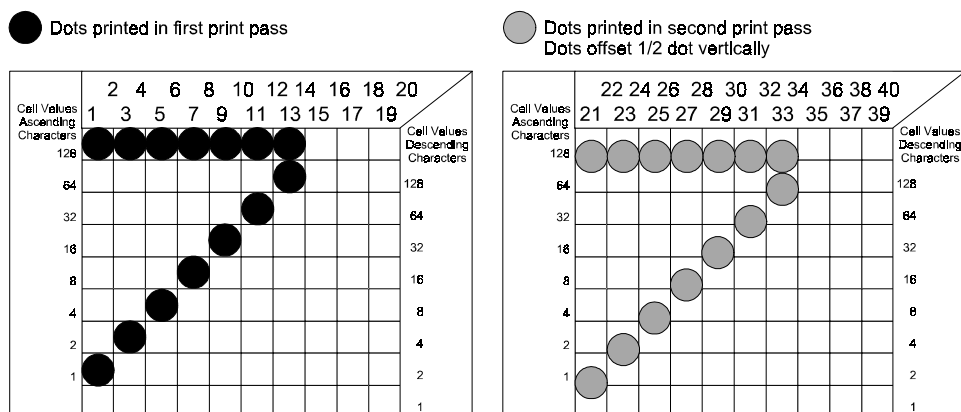
- Design characters in a style that is between draft and NLQ print quality. (This is sometimes referred to as correspondence quality.) The printer automatically calculates draft and NLQ from downloaded character data.
- Design and download data for NLQ characters. Downloaded NLQ characters may be printed only when NLQ printing is selected. When draft printing is selected, the printer prints random dots.

To design characters that are between draft and NLQ print quality, place dots within any of the cells. Ten columns of character data are sent to the printer. When NLQ printing is selected, the printer adds dots to the design of the character. When draft printing is selected, the printer omits some dots from adjacent columns. See the illustrations below.



**Print Quality, NLQ/Draft Characters**  
**Calculated from Correspondence Quality Download Character** AB0-U1

To design NLQ characters, place dots within any of the design matrix cells. Forty columns of character data are sent to the printer, twenty for each print pass. In the second print pass, the dots are offset vertically by one-half dot.



### Print Quality, NLQ Download Character

AB0-V1

In calculating the 40 columns of data, calculate the 10 columns of cell-value data as you would for the correspondence character mentioned earlier; that is, calculate by adding up the ascender or descender cell values of corresponding cells with dots. Then, for the NLQ character, include a zero value between each correspondence column value to create the 20 data bytes for the first NLQ pass. For the second NLQ pass, do the same but drop the leading column value and add a trailing zero value.

For example, for the "7" character above, the calculated column values are as follows:

Correspondence Column Values:

129 130 132 136 144 160 192 0 0 0

NLQ 1st Pass column Values:

129 0 130 0 132 0 136 0 144 0 160 0 192 0 0 0 0 0 0 0

NLQ 2nd Pass Column Values:

0 130 0 132 0 136 0 144 0 160 0 192 0 0 0 0 0 0 0 0

## STORING DOWNLOAD CHARACTERS

Download characters are stored in RAM (temporary memory). The character currently mapped to the same data byte value in ROM (permanent memory) is not overwritten. Characters that have not been downloaded, mapped, or overlayed print from the currently selected character set stored in ROM. (See the next subsection, "Printing Downloaded Characters".) If you select another character set or change emulation mode, your downloaded characters are not overwritten.

Downloaded characters remain in temporary memory, RAM, until:

- Cleared with the "Factory Reset" option on the configuration menu or with control command SOH AzX
- Overwritten with other selections
- Cleared by setting the "Input Buffer Size" option to "Maximum (no user-defined characters)" or by setting the "Overlay Characters" option to "None"
- Power is turned off

*Note:* Download characters may be retained for a variable amount of time after the power is turned off.

## PRINTING DOWNLOADED CHARACTERS

Follow this procedure to print downloaded characters:

1. Use the configuration menu to set the printer to accept downloaded characters.
2. Use the command SOH Az& to download characters to RAM as described in this section.
3. Select the downloaded characters for printing. Downloaded characters may be selected when created using SOH Az&. That setting may be changed at any time. You can print from downloaded characters stored in RAM or the currently selected character set stored in ROM, on a character-by-character basis, by changing the data byte source, using SOH Az%, as discussed earlier in this section.

You can print from all downloaded characters stored in RAM by changing the data byte source using SOH Az%, or the "Overlay Characters" option in the configuration menu.

The following pages describe the format of the command used to download characters. Examples and blank matrixes for designing your own characters are provided at the end of this subsection.

After your new characters are downloaded, you can use the "Print Data Byte Map" option on the configuration menu to see how they appear in print.

SOH A z &					Download Characters			
<i>ASCII:</i>	SOH	A	z	&	(m)	(n1)	(n2)	(a1 <sub>a</sub> )(a1 <sub>b</sub> )(c1)...(cx) ...
<i>Control:</i>	CTRL A	A	z	&	(m)	(n1)	(n2)	(a1 <sub>a</sub> )(a1 <sub>b</sub> )(c1)...(cx) ...
<i>Decimal:</i>	1	65	122	38	(m)	(n1)	(n2)	(a1 <sub>a</sub> )(a1 <sub>b</sub> )(c1)...(cx) ...
<i>Hexadecimal:</i>	01	41	7A	26	(m)	(n1)	(n2)	(a1 <sub>a</sub> )(a1 <sub>b</sub> )(c1)...(cx) ...

Defines and downloads to RAM (temporary memory) bit image data for one or more characters. Before downloading characters, use the configuration menu to set the printer to accept downloaded characters.

The format for downloading characters is shown here. Additional information on designing, storing, and printing download characters is given on the preceding pages.

In the Download Character command, m specifies whether the characters are selected for printing, or downloaded but not selected. This parameter performs the same function as the Select Character Source and Library command, SOH Az%, and that command may be used at any time to change the setting made here. This setting may also be changed using the "Overlay Characters" option on the configuration menu. The following are valid settings for m:

m = 0: Download but do not select

m = 1: Download and select immediately

n1 and n2 specify the range of data byte values to which the download characters are assigned. Data must be sent for each character in the range specified by n1 and n2. To download only one character, send the same data.

$a_a$  is a single data byte that specifies the vertical expansion characteristics of each download character. Bit values for  $a_a$  are as follows:

$a_a$ Bit	Setting
7	0 = Ascending character (such as h, d, A, R) 1 = Descending character (such as y, p, g)
2-6	Ignored
1 and 0	Vertical expansion as follows: 00 or 11: No vertical expansion 01: Line drawing character (data in Row 8 are copied into Rows 10, 11, and 12) 10: Shaded character (data in Rows 6, 7, and 8 are copied into Rows 10, 11, and 12)

Decimal values for  $a_a$  are as follows:

$a_a$	Setting
0 or 3	Ascending character, no vertical expansion
1	Line drawing character (Row 8 copied)
2	Shaded character (Rows 6, 7, and 8 copied)
128 or 131	Descending character
129	Descending character, line drawing (Row 8 copied)
130	Descending character, shaded (Rows 6, 7, and 8 copied)

$a_b$  is a single data byte that specifies the print quality of a downloaded character as follows:

- $a_b = 0$ : Draft/NLQ. Send 10 columns of character data for  $c_1$  through  $c_x$ . Draft and NLQ characters are automatically calculated from this data.

- $a_b = 1$ : Near Letter Quality. Send 40 columns of character data for c1 through cx. These characters may be printed only when NLQ printing is enabled.

See "Print Quality" earlier in this section.

***Both  $a_a$  and  $a_b$  must be provided for each character in the range n1 through n2.***

c1 through cx specify the columns of pin fire patterns for the downloaded character, and the intercharacter space. For example, if  $a_b = 0$ , send 10 columns of data: (c1)...(c10). If  $a_b = 1$ , send 40 columns of data: (c1)...(c40).

c1 through cx must accompany each character specified by  $a_a$  and  $a_b$  in the range n1 through n2.

To calculate c1 through cx, design the character within a matrix as shown earlier in this subsection.

*Note:* All cells may be defined, but the printer ignores any data entered in Column 10 (draft) and Columns 20 and 40 (NLQ).

Use the columns on the right side of the matrix to define the space between characters. The standard intercharacter space is two columns (Columns 8 and 9).

When the character is designed, add the cell values vertically by column for each row, beginning at the upper left. In the examples shown on the next page, the cell values for ascending characters are shown on the left side of the matrix. Ascending characters are printed by the top eight pins of the printhead. The cell values for descending characters are shown on the right side of the matrix. Descending characters are printed by the bottom eight pins of the printhead.



The sum of the values in Column 1 is the c1 value, the sum of the values in Column 2 is the c2 value, and so forth. Where no character data are entered in the matrix, enter zero as the c-value for that column.

## EXAMPLE 1

The example shows how to define and download the copyright symbol, ©:

Intercharacter Space											
Cell Values Ascending Characters	1	2	3	4	5	6	7	8	9	10	Cell Values Descending Characters
128			●	●	●						128
64		●				●				N	64
32	●			●	●		●			o	32
16	●		●				●			t	16
8	●		●				●			u	8
4	●			●	●		●			s	4
2		●				●				e	2
1			●	●	●					d	1
Not used											
Column Totals	60	66	153	165	165	66	60	0	0	0	

AB0-W1

The following BASIC program downloads this character to data byte value 35 decimal and select it for printing:

```

LPRINT CHR$(1);"Az&";CHR$(1);CHR$(35);CHR$(35);CHR$(0);CHR$(0);
FOR X = 1 TO 10
  READ Y
  LPRINT CHR$(Y);
NEXT X
DATA 60,66,153,165,165,66,60,0,0,0

```

## EXAMPLE 2

This example shows how to define and download a shaded character. The matrix below shows how to determine the data. When a shaded character is specified ( $a_a=2$  or 130), Rows 6, 7, and 8 are copied into three additional rows, 10 through 12, to produce the result shown in the matrix on the next page. c1 through cx are specified for the first 8 rows only, not for Rows 10, 11, and 12.

Cell Values Ascending Characters	1	2	3	4	5	6	7	8	9	10	Cell Values Descending Characters
128		●			●			●			128
64	●			●			●		●	N	64
32			●			●			●	O	32
16		●			●			●		t	16
8	●			●			●			U	8
4		●			●			●		S	4
2			●			●			●	e	2
1	●			●			●			d	1
Column Totals	73	148	34	73	148	34	73	148	34	0	

AB0-X1

*Note:* Print shaded characters and line drawing characters at 6 lpi line spacing to obtain the full effect of the extension.

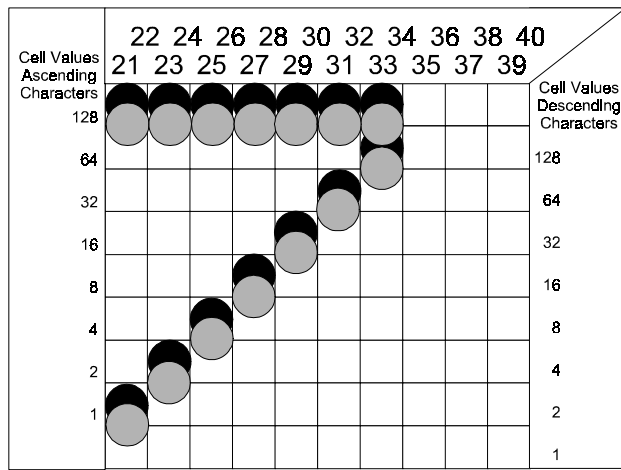
This matrix shows the dots the printer adds in Rows 10, 11, and 12 from the data specified in the matrix on the previous page.

Row	1	2	3	4	5	6	7	8	9	10
1		●			●			●		
2	●			●			●			N
3			●			●			●	o
4		●			●			●		t
5	●			●			●			
6		●			●			●		u
7			●			●			●	s
8	●			●			●			e
9										d
10		●			●			●		
11			●			●			●	
12	●			●			●			

Dots printed in first print pass



- Dots printed in first print pass
- Dots printed in second print pass  
Dots offset 1/2 dot vertically



AB0-ZA

The following BASIC program downloads this character to data byte value 48 decimal and selects it for printing. (The character is printed when NLQ printing is enabled.)

```
LPRINT CHR$(1);"Az&";CHR$(1);CHR$(48);CHR$(48);CHR$(0);CHR$(1);
FOR X = 1 TO 40
  READ Y
  LPRINT CHR$(Y);
NEXT X
DATA 129,0,130,0,132,0,136,0,144,0,160,0,192,0,0,0,0,0,0
DATA 0,130,0,132,0,136,0,144,0,160,0,192,0,0,0,0,0,0
```

Use the matrixes below to design your characters.

Cell Values Ascending Characters	1	2	3	4	5	6	7	8	9	10	Cell Values Descending Characters
128											128
64											64
32											32
16											16
8											8
4											4
2											2
1											1

Cell Values Ascending Characters	1	2	3	4	5	6	7	8	9	10	Cell Values Descending Characters
128											128
64											64
32											32
16											16
8											8
4											4
2											2
1											1

Cell Values Ascending Characters	1	2	3	4	5	6	7	8	9	10	Cell Values Descending Characters
128											128
64											64
32											32
16											16
8											8
4											4
2											2
1											1

Cell Values Ascending Characters	1	2	3	4	5	6	7	8	9	10	Cell Values Descending Characters
128											128
64											64
32											32
16											16
8											8
4											4
2											2
1											1

Row	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										

Row	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										

## GRAPHICS

SOH A z *					Universal Graphics					
<i>ASCII:</i>	SOH	A	z	*	(d1)	(d2)	(r)	(c1)	(c2)	(g1)..(gx)
<i>Control:</i>	CTRL A	A	z	*	(d1)	(d2)	(r)	(c1)	(c2)	(g1)..(gx)
<i>Decimal:</i>	1	65	122	42	(d1)	(d2)	(r)	(c1)	(c2)	(g1)..(gx)
<i>Hexadecimal:</i>		01	41	7A	2A	(d1)	(d2)	(r)	(c1)	(c2)(g1)..(gx)

This command causes the printer to print graphics.

d1 and d2 specify the graphics density to be printed. d1 is the least significant (lower) byte of the graphics density, and d2 is the most significant (upper) byte. r specifies graphics resolution as follows:

r = 0: skip horizontally adjacent dots (this setting may increase graphics print speed)

r = 1: print all dots

c1c2 specify the number of dot columns to reserve for graphics. (c1 is the least significant byte and c2 is the most significant byte of the represented number.) The method of representing the number of dot columns is the same way as that for d1d2, described in the following paragraph.

d1d2 specify the graphic density. If the value is less than 256, d1 is the number itself and d2 is 0. For values over 256, divide the total number of 256. d2 is the number of complete groups of 256, and d1 is the remainder. For example, 120 is expressed as 120 0, and 360 is expressed as 1 104.

Graphic density options and corresponding maximum available dot columns are shown on the next page.

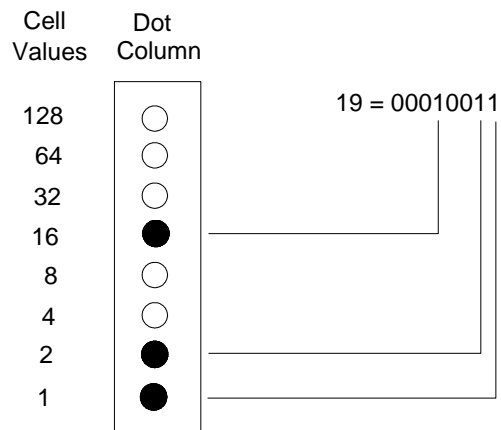


10 Pitch		12 Pitch	
Density (d1d2)	Maximum Dot Columns Per Line (c1c2)	Density (d1d2)	Maximum Dot Columns Per Line (c1c2)
50	680	60	816
60	816	72	979
75	1020	90	1224
100	1360	120	1632
120	1632	144	1958
150	2040	180	2448
200	2720	240	3264
240	3264	288	3917
300	4080	360	4896

g1 through gx specify the pin fire patterns for each dot column. The x in gx refers to the maximum number of dot columns that can be reserved for the specified graphics density, as shown above.

Eight of the 9 printhead pins are used to print graphics. To calculate g1 through gx, design each dot column as a cell that is 8-dot-rows high, then add the cell values vertically for each dot column. The value of g for each column can be expressed as a decimal number: the bits set to 1 correspond to the printhead pins that fire to create dots in each pattern. If a bit is set, the corresponding pin fires. If it is not set, the corresponding pin does not fire. See the figure and example that follow.

For example, if g1=19 (decimal), the corresponding binary expression is 0010011. The pins fire in the following pattern:



AB0-AG1

The printer does not print until it receives sufficient data to fill all dot columns reserved for graphics. Therefore, if dot column space is reserved beyond the area in which printing occurs, it must be filled with nulls (decimal 0s).

The figure below shows how to determine the values for g1..gx to print an X-shaped graphic pattern:

Cell Values	Dot Columns							
	1	2	3	4	5	6	7	8
128	●							●
64		●					●	
32			●			●		
16				●	●			
8				●	●			
4			●			●		
2		●					●	
1	●							●
Column Totals g1 to g8	129	66	36	24	24	36	66	129

AB0-AE

*Note:* n/216 vertical line spacing may be used in graphics printing. n/216 in. line spacing is approximated using 1/144 in. steps. Maximum local and cumulative error is -1/216 in.

```

REM PRINT AN X-SHAPED PATTERN USING 60 DPI DENSITY GRAPHICS
LPRINT CHR$(1);"Az*";CHR$(60);CHR$(0);CHR$(1);CHR$(80);CHR$(0);
FOR I = 1 TO 8
  READ D
  LPRINT CHR$(D);
NEXT I
LPRINT
DATA 129,66,36,24,24,36,66,129

```



---

# **Epson FX-100 Control Commands**

---

This section describes the control codes and control commands you can use in Epson FX-100 emulation mode.

Before using these commands, read the section entitled "Control Commands—An Introduction." It describes the typographic conventions used in this section and other information needed to send these commands in the correct format.

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---

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## ALPHABETICAL SUMMARY

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## UNAVAILABLE EPSON FX-100 CONTROL COMMANDS

The following commands are not available in Epson emulation mode:

- ESC EM      Cut Sheet Feeder Mode
- ESC SP      Intercharacter Space
- ESC %      User Defined Character Set
- ESC &      Define User-Defined Characters
- ESC 8      Disable Paper End Detector
- ESC 9      Enable Paper End Detector
- ESC ^      9-Pin Graphics Mode
- ESC ?      Re-assign 8-Pin Graphics
- ESC :      Copy ROM to RAM
- ESC p      Proportional Space Mode

Some of the functions listed above can be performed with Universal Control Commands, as follows:

### **Epson Control Sequence**

ESC %, User-Defined Character Set

ESC :, Copy ROM to RAM

ESC &, Define User-Defined Characters

### **Equivalent Universal Control Command**

SOH A z %, Select Character Source/Library

Function not required to map or download characters

SOH A z &, Download Character

## CHARACTER SETS

ESC R				National-Use Character Maps	
<i>ASCII:</i>	ESC	R	(n)		
<i>Control:</i>	CTRL [	R	(n)		
<i>Decimal:</i>	27	82	(n)		
<i>Hexadecimal:</i>		1B	52	(n)	

Selects a national-use character map. The selected character map remains in effect until this control command is sent to the printer again. *n* specifies the national-use character map as follows:

<b>n</b>	<b>Character Map</b>	<b>n</b>	<b>Character Map</b>
0	United States	8	Japan
1	Japan	9	Norway
2	Germany	10	Denmark II
3	United Kingdom	11	Spain II
4	Denmark I	12	Latin America
5	Sweden	128	Hebrew
6	Italy (Epson)	129	Italy (ANSI)
7	Spain I		

See Appendix D for charts showing the national-use character maps.

This command applies only to the Epson Character Set. If an IBM Character Set is currently in use, ESC R does not take effect until the Epson Character Set is selected from the configuration menu.

### *Example*

```
REM SELECT THE GERMAN CHARACTER MAP
LPRINT CHR$(27);"R";CHR$(2);
```

ESC 6    Select IBM Character Set #2 (or Expand Printable Characters)			
ASCII:	ESC	6	
Control:	CTRL [	6	
Decimal:	27	54	
Hexadecimal:	1B	36	

If the printer is currently set with an IBM character set, this command causes it to print IBM Character Set #2.

If the printer is currently set with an Epson Character Set, this command expands the printable characters to include data byte values 128 to 159 (decimal).

See Appendix D for charts of character sets.

ESC 7    Select IBM Character Set #1 (or Standard Printable Characters)			
ASCII:	ESC	7	
Control:	CTRL [	7	
Decimal:	27	55	
Hexadecimal:	1B	37	

If the printer is currently set with an IBM character set, this command causes it to print IBM Character Set #1.

If the printer is currently set with an Epson Character Set, this command causes data byte values 128 to 159 (decimal) to become nonprintable characters (cancels ESC 6).

See Appendix D for charts of character sets.

ESC I		Control Codes/Printable Characters	
<i>ASCII:</i>	ESC	I	(n)
<i>Control:</i>	CTRL [	I	(n)
<i>Decimal:</i>	27	73	(n)
<i>Hexadecimal:</i>	1B	49	(n)

Specifies whether the undefined data bytes from 0 to 31 decimal (00 to 1F hexadecimal) and 128 to 159 decimal (80 to 9F hexadecimal) are control codes or printable characters. ESC I does not affect the defined control codes such as BEL, BS, HT, etc. See the chart in Appendix D.

n indicates whether the data byte values are control codes or printable characters as follows:

- n = 0 or 48: Control codes (ignore undefined characters)
- n = 1 or 49: Printable characters

This control sequence works only if you have selected an Epson Character Set.

### *Example*

```
REM SET AS CONTROL CODES
LPRINT CHR$(27);"I";CHR$(0);
REM SET AS PRINTABLE CHARACTERS
LPRINT CHR$(27);"I"CHR$(1);
```

## FORM LENGTH

ESC C				Length of Form in Lines
<i>ASCII:</i>	ESC	C	(n)	
<i>Control:</i>	CTRL [	C	(n)	
<i>Decimal:</i>	27	67	(n)	
<i>Hexadecimal:</i>		1B	43	(n)

Sets form length to n number of lines. n must be from 1 to 127. The default setting is 66 lines. The current form position becomes the top of form when the printer receives this command.

If the bottom margin was previously set by the Skip Over Perforation command (ESC N), the Length of Form in Lines command cancels the bottom margin setting. Therefore, to re-establish the bottom margin after Length of Form in Lines is set, send another Skip Over Perforation command.

Form length is stored as an absolute length equal to the line spacing multiplied by the specified number of lines. That form length remains in effect even if the line spacing is changed.

### *Example*

```
REM SET FORM LENGTH TO 50 LINES
LPRINT CHR$(27);"C";CHR$(50);
```

ESC C NUL				Length of Form in Inches
<i>ASCII:</i>	ESC	C	NUL	(n)
<i>Control:</i>	CTRL [	C	NUL	(n)
<i>Decimal:</i>	27	67	0	(n)
<i>Hexadecimal:</i>	1B	43	00	(n)

Sets form length to an integer number, n, of inches. n must be from 1 to 22. The default is 11 in. The current form position becomes the top of form when the printer receives this command.

If the bottom margin was previously set by the Skip Over Perforation command (ESC N), the Length of Form in Inches command cancels the bottom margin setting. Therefore, to re-establish the bottom margin after Length of Form in Inches is set, send another Skip Over Perforation command.

#### *Example*

```
REM SET FORM LENGTH TO 10 INCHES
LPRINT CHR$(27);"C";CHR$(0);CHR$(10);
```

## GRAPHICS

ESC K		Single-Density Graphics			
<i>ASCII:</i>	ESC	K	(n1)	(n2)	(d1)...(d816)
<i>Control:</i>	CTRL [	K	(n1)	(n2)	(d1)...(d816)
<i>Decimal:</i>	27	75	(n1)	(n2)	(d1)...(d816)
<i>Hexadecimal:</i>	1B	4B	(n1)	(n2)	(d1)...(d816)

Causes the printer to print single-density-graphics dot columns. Single-density graphics are printed 60 dot columns per horizontal inch.

n1 and n2 specify the number of dot columns (data bytes) to reserve for graphics. The maximum number of dot columns per line for single-density graphics is 816. n1 and n2 are calculated as follows:

- $n1 = X \text{ MOD } 256$
- $n2 = \text{INT}(X/256)$

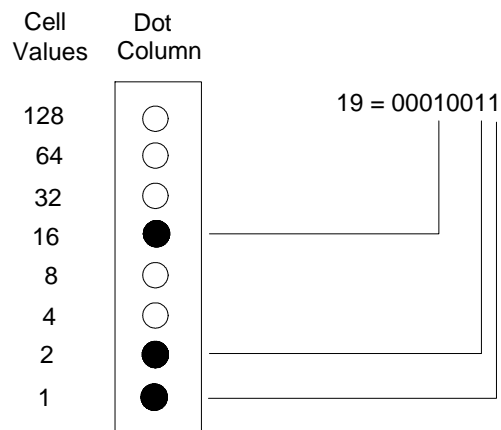
where X equals the number of dot columns to reserve. For example, if the number of dot columns is 80:

- $n1 = 80 \text{ MOD } 256 = 80$
- $n2 = \text{INT}(80/256) = 0$

d1...d816 are decimal numbers from 0 to 255, each representing a dot column. Each decimal number has a corresponding 8-bit binary expression. The bits set to logic 1 in the binary expression correspond to the printhead pins that fire to create dots in each dot column. If a bit is set, the corresponding pin fires. If it is not set, the corresponding pin does not fire. See the figure on the next page and the example that follows.



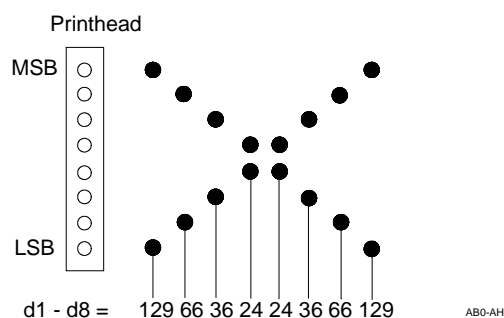
For example, if d1 is 19 (decimal), the corresponding binary expression is 00010011. Pins 8, 7, and 4 fire.



AB0-AG1

The printer does not print until it receives sufficient data to fill all dot columns reserved for graphics. Therefore, if dot column space is reserved beyond the area in which printing occurs, it must be filled with nulls (decimal 0s).

The following example shows the code necessary to cause the printer to print the following graphic pattern:



*Note:* n/216 vertical line spacing may be used in graphic printing. n/216 in. line spacing is approximated using 1/144 in. steps. Maximum local and cumulative error is - 1/216 in.

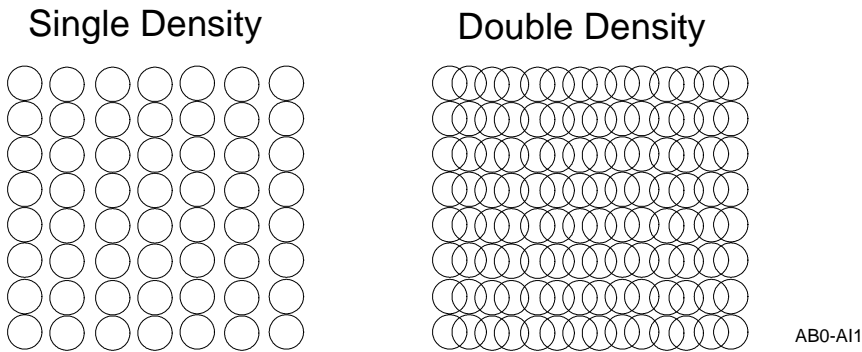
### Example

```
REM PRINT AN X SHAPED PATTERN USING SINGLE
REM DENSITY GRAPHICS
LPRINT CHR$(27);"K";CHR$(8);CHR$(0);
FOR I = 1 TO 8
  READ D
  LPRINT CHR$(D);
NEXT I
LPRINT
DATA 129,66,36,24,24,36,66,129
```

ESC L or ESC Y				Double-Density Graphics	
ASCII:	ESC	L	(n1)	(n2)	(d1)...(d1632)
Control:	CTRL [	L	(n1)	(n2)	(d1)...(d1632)
Decimal:	27	76	(n1)	(n2)	(d1)...(d1632)
Hexadecimal:	1B	4C	(n1)	(n2)	(d1)...(d1632)
ASCII:	ESC	Y	(n1)	(n2)	(d1)...(d1632)
Control:	CTRL [	Y	(n1)	(n2)	(d1)...(d1632)
Decimal:	27	89	(n1)	(n2)	(d1)...(d1632)
Hexadecimal:	1B	59	(n1)	(n2)	(d1)...(d1632)

Causes the printer to print double-density graphics. Double-density graphics are printed 120 dot columns per horizontal in.

The following illustrates the difference between single-density and double-density graphics:



Use ESC L to print double-density graphics at double-density speed.

Use ESC Y to print double-density graphics at single-density speed. ESC Y causes alternate dots to be skipped during printing.

The maximum number of dot columns that can be reserved per line in double-density graphics is 1632.

*Note:*  $n/216$  vertical line spacing may be used in graphic printing.  $n/216$  in. line spacing is approximated using  $1/144$  in. steps. Maximum local and cumulative error is  $- 1/216$  in.

The operation of double-density graphics and quad density is the same as single density. For more information, refer to the description of the Single-Density Graphics command (ESC K).

*Example*

```
REM PRINT 2 SOLID BARS 150 DOT PATTERNS IN  
REM LENGTH USING DOUBLE DENSITY GRAPHICS  
FOR I = 1 TO 2  
LPRINT CHR$(27);"L";CHR$(150);CHR$(0);  
FOR J = 1 TO 150  
LPRINT CHR$(255);  
NEXT J  
LPRINT  
NEXT I  
END
```

ESC Z			Quad-Density Graphics		
<i>ASCII:</i>	ESC	Z	(n1)	(n2)	(d1)...(d3264)
<i>Control:</i>	CTRL [	Z	(n1)	(n2)	(d1)...(d3264)
<i>Decimal:</i>	27	90	(n1)	(n2)	(d1)...(d3264)
<i>Hexadecimal:</i>	1B	5A	(n1)	(n2)	(d1)...(d3264)

Causes the printer to print quadruple-density graphics. Quadruple-density graphics are printed in synthesized 240 dot columns per horizontal in. The maximum number of dot columns that can be reserved per line in quad density graphics is 3264.

The printer prints half as many dot columns as it receives. Adjacent columns are paired, and if corresponding bits in either dot column are set, a pin is fired to create a dot.

#### *Example*

```
REM PRINT 2 SOLID BARS 150 DOT PATTERNS IN
REM LENGTH USING QUAD DENSITY GRAPHICS
FOR I = 1 TO 2
  LPRINT CHR$(27);"Z";CHR$(150);CHR$(0);
  FOR J = 1 TO 150
    LPRINT CHR$(255);
  NEXT J
  LPRINT
NEXT I
END
```

ESC *			Graphics Mode Selection			
<i>ASCII:</i>	ESC	*	(m)	(n1)	(n2)	(d1)...(dx)
<i>Control:</i>	CTRL [	*	(m)	(n1)	(n2)	(d1)...(dx)
<i>Decimal:</i>	27	42	(m)	(n1)	(n2)	(d1)...(dx)
<i>Hexadecimal:</i>	1B	2A	(m)	(n1)	(n2)	(d1)...(dx)

Causes the printer to print graphics in the density specified by m as follows:

- 0=Single Density, (60 dots/in.)
- 1=Double Density, (120 dots/in.)
- 2=High-Speed Double Density, (120 dots/in.)
- 3=Quad Density, (240 dots/in.)
- 4=75 dots/in.
- 5=50 dots/in.
- 6=75 dots/in.

The "x" in dx refers to the maximum number of dot columns that can be reserved. The maximum number of d-bytes depends on the density, specified as follows:

Dots/in.	Maximum No. of d-bytes where x (of dx) =
60	816
120	1632
240	3264
75	1020
50	680

Refer to the explanation of the Single-Density Graphics command (ESC K) for information about n1 and n2 and specifics on how to use graphics.

### Example

```
REM PRINT AN X SHAPED PATTERN USING SINGLE
REM DENSITY GRAPHICS
LPRINT CHR$(27);"*";CHR$(0);CHR$(8);CHR$(0);
FOR I = 1 TO 8
  READ D
```

```
LPRINT CHR$(D);
NEXT I
DATA 129,66,36,24,24,36,66,129
```

## LINE SPACING

ESC 1				7/72 inch
ASCII:	ESC	1		
Control:	CTRL [	1		
Decimal:	27	49		
Hexadecimal:		1B	31	

Sets all subsequent line spacing at 7/72 in. (10.3 lines per in.).

ESC Ø				1/8 inch
ASCII:	ESC	Ø		
Control:	CTRL [	Ø		
Decimal:	27	48		
Hexadecimal:	1B	30		

Sets all subsequent line spacing at 1/8 in. (8 lines per in.).

ESC 2				1/6 inch
ASCII:	ESC	2		
Control:	CTRL [	2		
Decimal:	27	50		
Hexadecimal:		1B	32	

Sets all subsequent line spacing at 1/6 in. (6 lines per in.).

ESC A				n/72 inch
ASCII:	ESC	A	(n)	
Control:	CTRL [	A	(n)	
Decimal:	27	65	(n)	
Hexadecimal:	1B	41	(n)	

Sets all subsequent line spacing at n/72 in. The valid entries for n are 1 to 85.

ESC 3 or ESC J				n/216 inch
ASCII:	ESC	3	(n)	
Control:	CTRL [	3	(n)	
Decimal:	27	51	(n)	
Hexadecimal:	1B	33	(n)	
ASCII:	ESC	J	(n)	
Control:	CTRL [	J	(n)	
Decimal:	27	74	(n)	
Hexadecimal:	1B	4A	(n)	

Sets line spacing at n/216 in. The valid entries for n are 1 to 255.

n/216 in. line spacing is approximated using 1/144 in. steps. Maximum local and cumulative error is - 1/216 in.

- ESC 3 (n) causes all subsequent line spacing to be set at n/216.
- ESC J (n) prints all data in the print buffer, clears the print buffer, then advances the paper n/216 in., one time only. ESC J does not perform a carriage return with the linefeed.

*Note:* n/216 in. line spacing is called "Graphics Line Spacing" by some manufacturers. Use a line spacing of 24/216 in. for bit-image graphics using eight bits.

### *Example*

```
REM "Prints buffer & advances paper 1 in."
LPRINT CHR$(27);CHR$(74);CHR$(216);
```



## MARGINS

ESC •				Set Left Margin
<i>ASCII:</i>	ESC	•	(n)	
<i>Control:</i>	CTRL [	•	(n)	
<i>Decimal:</i>	27	108	(n)	
<i>Hexadecimal:</i>	1B	6C	(n)	

Sets the left margin to column n. The valid range for n is from 1 to one column less than the right margin setting. The left margin is the first column in which characters is printed.

ESC Q				Set Right Margin
<i>ASCII:</i>	ESC	Q	(n)	
<i>Control:</i>	CTRL [	Q	(n)	
<i>Decimal:</i>	27	81	(n)	
<i>Hexadecimal:</i>	1B	51	(n)	

Sets the right margin to column n. This command must be specified at the beginning of a line.

The value of n for the right margin depends on the setting of the left margin and the selected pitch:

- 5.0 pitch: LM + 1  $\mu$  n  $\mu$  68
- 6.0 pitch: LM + 1  $\mu$  n  $\mu$  81
- 7.5 pitch: LM + 1  $\mu$  n  $\mu$  102
- 8.33 pitch: LM + 1  $\mu$  n  $\mu$  113
- 8.57 pitch: LM + 1  $\mu$  n  $\mu$  116
- 9.1 pitch: LM + 1  $\mu$  n  $\mu$  123
- 10.0 pitch: LM + 1  $\mu$  n  $\mu$  136
- 12.0 pitch: LM + 1  $\mu$  n  $\mu$  163

- 15.0 pitch: LM + 1  $\mu$  n  $\mu$  204
- 16.67 pitch: LM + 1  $\mu$  n  $\mu$  226
- 17.14 pitch: LM + 1  $\mu$  n  $\mu$  233
- 18.2 pitch: LM + 1  $\mu$  n  $\mu$  247

where LM is the setting for the left margin. If n is greater than the upper limit, the command is ignored and the previous right margin setting remains in effect.

ESC N		Skip Over Perforation	
ASCII:	ESC	N	(n)
Control:	CTRL [	N	(n)
Decimal:	27	78	(n)
Hexadecimal:	1B	4E	(n)

Sets the bottom margin to n number of lines. n must be from 1 to 127.

When the form length is changed by using the Length of Form by Lines command (ESC C) or the Length of Form in Inches Command (ESC C NUL), the bottom margin setting is cancelled. To regain the bottom margin setting, use ESC N following either ESC C or ESC C (NUL).

### *Example*

REM SET FORM LENGTH TO 55 LINES AND RESET

REM BOTTOM MARGIN TO 3 LINES

LPRINT CHR\$(27);"C";CHR\$(55);

LPRINT CHR\$(27);"N";CHR\$(3);

ESC O		Cancel Skip Over Perforation	
ASCII:	ESC	O	
Control:	CTRL [	O	
Decimal:	27	79	
Hexadecimal:	1B	4F	

Cancels the bottom margin setting set with ESC N.

## MISCELLANEOUS

ESC @	Printer Initialization
ASCII: ESC @	
Control: CTRL [ @	
Decimal: 27 64	
Hexadecimal: 1B 40	

Initializes the printer. This command initiates the same process as turning the printer on. The printer functions as specified by the configuration menu.

ESC @ also cancels the print line of characters in which it occurs.

CR	Carriage Return
ASCII: CR	
Control: CTRL M	
Decimal: 13	
Hexadecimal: 0D	

Prints any data stored in the print buffer, and sets the current column position to the left margin. If Auto Linefeed (LF on CR) is enabled, a linefeed is performed after the carriage return.

BEL	Bell
ASCII: BEL	
Control: CTRL G	
Decimal: 7	
Hexadecimal: 07	

Sounds the beeper once, for approximately 0.1 second.

BS	Backspace
ASCII: BS Control: CTRL H Decimal: 8 Hexadecimal: 08	

Prints any data in the print buffer, then backs up one column for the next starting position. This is used to create overstrike characters.

If you have changed the character pitch before sending the BS control code, the distance the printer backs up may be inaccurate.

LF	Linefeed
ASCII: LF Control: CTRL J Decimal: 10 Hexadecimal: 0A	

Prints any data in the print buffer and advances the paper one line. If Auto Carriage Return (CR on LF) is enabled, a carriage return is performed after the linefeed.

This control code cancels control code SO.

FF	Form Feed
ASCII: FF Control: CTRL L Decimal: 12 Hexadecimal: 0C	

Prints any data in the print buffer and advances the paper to the next top of form. If Auto Carriage Return (CR on LF) is enabled, a carriage return is performed after the form feed. Otherwise, printing continues in the next column to the right.

This control code cancels control code SO.

DEL	Delete Last Character
ASCII: DEL Control: not applicable Decimal: 127 Hexadecimal: 7F	

Deletes the last character in the print buffer.

CAN	Cancel Data in Print Buffer
ASCII: CAN Control: CTRL X Decimal: 24 Hexadecimal: 18	

Cancels all data currently in the print buffer.

The right margin becomes the current print position.

ESC s	Half-Speed Printing
ASCII: ESC    s    (n) Control: CTRL [    s    (n) Decimal: 27    115    (n) Hexadecimal: 1B    73    (n)	

Starts or cancels half-speed printing. Half-speed printing causes the printer to run at 50 percent of the normal speed. It is an effective way to reduce print noise and improve horizontal alignment. *n* specifies whether it is set or cancelled as follows:

*n* =1 or 49: Start half-speed printing

*n* =0 or 48: Cancel half-speed printing

The printer uses half-speed printing when the operator access door is open.

*Example*

```
REM START HALF-SPEED PRINTING
LPRINT CHR$(27);"s";CHR$(1);
LPRINT "This is a test."
REM CANCEL HALF-SPEED PRINTING
LPRINT CHR$(27);"s";CHR$(0);
LPRINT "This is a test."
```

DC1	Select Printer
ASCII: DC1 Control: CTRL Q Decimal: 17 Hexadecimal: 11	

Sets the printer to accept data from the computer after it has been deselected by DC3 in the serial mode. This code does not place the printer on line if it has been placed off line by pressing **ON LINE**. DC1 is the X-ON character.

See Appendix B for details regarding software handshaking.

DC3	Deselect Printer on Serial Port
ASCII: DC3 Control: CTRL S Decimal: 19 Hexadecimal: 13 07	

Deselects printer when used with a serial interface.

Treated as a null on the parallel interface. On the serial interface, the printer sends this control code to indicate its buffer is full. DC3 is the X-OFF character.

See Appendix B for details regarding software handshaking.

ESC =			Clear MSB
ASCII:	ESC	=	
Control:	CTRL [	=	
Decimal:	27	61	
Hexadecimal:	1B	3D	

Forces the most significant bit (MSB) of character codes to logic 0 so that characters are printed from the lower half of Epson character sets (as non-italic characters). Overrides the logic of the MSB in data sent from the host. ESC = is cancelled by ESC #.

ESC >			Set MSB
ASCII:	ESC	>	
Control:	CTRL [	>	
Decimal:	27	62	
Hexadecimal:	1B	3E	

Forces the most significant bit (MSB) of character codes to logic 1 so that characters are printed from the upper half of Epson character sets (as italic characters). Overrides the logic of the MSB in data sent from the host. ESC > is cancelled by ESC #.

ESC #			Cancel MSB Control
ASCII:	ESC	#	
Control:	CTRL [	#	
Decimal:	27	35	
Hexadecimal:	1B	23	

Cancels MSB control enforced by ESC = or ESC >. Causes the printer to return to the left margin, then print from left to right for one line only.

## PRINT DIRECTION

ESC <		One-Line Unidirectional Printing
ASCII:	ESC	<
Control:	CTRL [	<
Decimal:	27	60
Hexadecimal:	1B	3C

Causes the printer to return to the left margin, then print from left to right for one line only.

*Note:* If set to ON, "PRINT STYLE, BiDirectional Graphics / NLQ" in the configuration menu overrides unidirectional printing.

ESC U		Unidirectional/Bidirectional Printing
ASCII:	ESC	U (n)
Control:	CTRL [	U (n)
Decimal:	27	85 (n)
Hexadecimal:	1B	55 (n)

Causes the printer to print unidirectionally or bidirectionally as indicated by n:

- n = 1 or 49: Unidirectional printing
- n = 0 or 48: Bidirectional printing

When unidirectional printing is selected, data is printed only when the printhead is moving from left to right. Printing this way improves vertical character alignment.

When bidirectional printing is selected, data is printed when the printhead is moving in both directions. This is the default print mode.

*Note:* If set to ON, "PRINT STYLE, Bi-Directional Graphics / NLQ" in the configuration menu overrides unidirectional printing.



## PRINT STYLE

ESC !				Set Pitch and Strike
ASCII:	ESC	!	(n)	
Control:	CTRL [	!	(n)	
Decimal:	27	33	(n)	
Hexadecimal:		1B	21 (n)	

Specifies the number of characters per inch (pitch) and degree of boldness (strike). The entries for n are as follows:

n	Pitch	Strike	n	Pitch	Strike
5	18.2	Single	37	9.1	Single
21	18.2	Double	53	9.1	Double
13	18.2	Bold	45	9.1	Bold
29	18.2	Extra Bold	61	9.1	Extra Bold
4	16.67	Single	36	8.33	Single
20	16.67	Double	52	8.33	Double
12	16.67	Bold	44	8.33	Bold
28	16.67	Extra Bold	60	8.33	Extra Bold
1	12.0	Single	33	6.0	Single
17	12.0	Double	49	6.0	Double
9	12.0	Bold	41	6.0	Bold
25	12.0	Extra Bold	57	6.0	Extra Bold
0	10.0	Single	32	5.0	Single
16	10.0	Double	48	5.0	Double
8	10.0	Bold	40	5.0	Bold
24	10.0	Extra Bold	56	5.0	Extra Bold

*Note:* To select 15.0 pitch or 7.5 pitch, use the universal control command SOH Az! or ESC Az!.

See the example on the next page.

*Example*

```
REM SET TO 20 PITCH, SINGLE STRIKE
LPRINT CHR$(27);"!";CHR$(5);
LPRINT "20 pitch in single strike."
REM SET TO 5 PITCH, EXTRA BOLD STRIKE
LPRINT CHR$(27);"!";CHR$(56);
LPRINT "5 pitch in extra bold."
```

SI or ESC SI		Condensed Pitch
ASCII:	SI	
Control:	CTRL O	
Decimal:	15	
Hexadecimal:	0F	
ASCII:	ESC	SI
Control:	CTRL [	CTRL O
Decimal:	27	15
Hexadecimal:	1B	0F

Increases character pitch according to the table below. Increasing character pitch allows more characters to be printed per line. ESC SI duplicates the function of the SI command.

Current Pitch	After SI or ESC SI
5.0	8.33
6.0	9.1
7.5	9.1
10.0	16.67
12.0	18.2
15.0	18.2

Current character pitches of 8.33, 8.57, 9.1, 16.67, 17.14, and 18.2 are unaffected by this command. See DC2 to cancel condensed pitch.

*Example*

```
REM SET TO 10 PITCH, THEN
REM CHANGE TO 17.14 PITCH, AS FOLLOWS
LPRINT CHR$(27);CHR$(33);CHR$(0);
LPRINT "Now printing in 10 cpi."
```

```
LPRINT CHR$(15);
LPRINT "Now printing in 17.14 cpi."
LPRINT CHR$(13);
```

DC2	Cancel Condensed Pitch
ASCII: DC2	
Control: CTRL R	
Decimal: 18	
Hexadecimal: 12	

Cancels condensed pitch set by SI or ESC SI. Returns to the pitch that was set prior to using SI or ESC SI.

Previous Pitch	New Pitch (After SI or ESC SI)	After DC2
5.0	8.33	5.0
6.0	9.1	6.0
7.5	9.1	7.5
10.0	16.67	10.0
12.0	18.2	12.0
15.0	18.2	15.0

*Note:* To reset 7.5 or 15.0 pitch, use the universal control command SOH Az!.

### *Example*

```
REM CHANGE FROM 10 PITCH TO 17.14 PITCH
LPRINT CHR$(15);
LPRINT "Printing in 17.14 pitch."
REM CANCEL 17.14 PITCH, RETURN TO 10 PITCH
LPRINT CHR$(18);
LPRINT "Printing in 10 pitch."
```

ESC M			Select Elite Pitch
ASCII:	ESC	M	
Control:	CTRL [	M	
Decimal:	27	77	
Hexadecimal:	1B	4D	

Selects elite pitches according to the table below. Current character pitches of 6.0, 8.33, 9.1, 12.0, 16.67, and 18.2 are unaffected by this command.

Current Pitch	After ESC M
5.0	6.0
8.57	9.1
10.0	12.0
15.0	12.0
17.14	18.2

ESC P			Cancel Elite Pitch
ASCII:	ESC	P	
Control:	CTRL [	P	
Decimal:	27	80	
Hexadecimal:	1B	50	

Cancels elite pitches and selects pica pitches according to the table below. Current character pitches of 5.0, 8.33, 8.57, 10.0, 16.67, and 17.14 are unaffected by this command.

Current Pitch	After ESC P
6.0	5.0
9.1	8.33
12.0	10.0
15.0	10.0
18.2	16.67

SO or ESC SO		Enlarged Pitch
ASCII:	SO	
Control:	CTRL N	
Decimal:	14	
Hexadecimal:	0E	
ASCII:	ESC	SO
Control:	CTRL [	CTRL N
Decimal:	27	14
Hexadecimal:	1B	0E

Enlarges the currently selected pitch as follows:

Current Pitch	After SO or ESC SO
18.2	9.1
17.14	8.57
16.67	8.33
15.0	7.5
12.0	6.0
10.0	5.0

See the BASIC example under DC4.

SO causes the enlarged pitch to remain in effect for one line only, or until one of the following is received:

- LF    ESC W (0)    SOH A z ! (n)
- FF    ESC W (48)    ESC A z ! (n)
- DC4    ESC ! (n)

*Note:* Enlarged pitch is called "Double Wide Printing" by some manufacturers. This command is not valid when NLQ printing is selected.

DC4	Cancel Enlarged Pitch
ASCII: DC4 Control: CTRL T Decimal: 20 Hexadecimal: 14	

Cancels enlarged pitch set with command SO or ESC SO. See the table below.

Pitch Set with SO or ESC SO	After DC4
9.1	18.2
8.57	17.14
8.33	16.67
7.5	15.0
6.0	12.0
5.0	10.0

This command does not cancel enlarged pitches set with ESC W (n), ESC ! (n), SOH A z ! (n), or ESC A z ! (n).

### *Example*

```
REM SET TO 10 PITCH.  
REM AFTER THAT ENLARGE TO 5 PITCH.  
REM FINALLY, CANCEL ENLARGED PITCH  
REM TO RETURN TO 10 PITCH, AS FOLLOWS  
LPRINT CHR$(27);CHR$(33);CHR$(0);  
LPRINT "Now printing in 10 cpi."  
LPRINT CHR$(14);  
LPRINT "Now printing in 5 cpi."  
LPRINT CHR$(20);  
LPRINT "Now printing in 10 cpi again."  
LPRINT CHR$(13);
```

**ESC W Set/Cancel Enlarged Pitch**

<i>ASCII:</i>	ESC	W	(n)
<i>Control:</i>	CTRL [	W	(n)
<i>Decimal:</i>	27	87	(n)
<i>Hexadecimal:</i>	1B	57	(n)

Sets and cancels enlarged pitch. n specifies whether the function is set or cancelled:

- n = 1 or 49: Set enlarged pitch
- n = 0 or 48: Cancel enlarged pitch

Setting enlarged pitch causes the currently selected pitch to become enlarged as follows:

<b>Current Pitch</b>	<b>After ESC W (1)</b>	<b>Previous Pitch</b>	<b>After ESC W (0)</b>
18.2	9.1	9.1	18.2
16.67	8.33	8.33	16.67
15.0	7.5	7.5	15
12.0	6.0	6.0	12
10.0	5.0	5.0	10

ESC W (1) or ESC W (49) causes enlarged pitch to remain in effect until changed by one of the following:

- ESC W (0) ESC A z ! (n)
- ESC W (48) SOH A z ! (n)
- ESC ! (n)

*Note:* Enlarged pitch is called "Double Wide Printing" by some manufacturers. This command is not valid when NLQ printing is selected.

*Example*

```
REM SET ENLARGED PITCH
LPRINT CHR$(27);"W";CHR$(1);"This is large."
REM CANCEL ENLARGED PITCH
LPRINT CHR$(27);"W";CHR$(0);"This is small."
```

ESC x			Set/Cancel NLQ
ASCII:	ESC	x	(n)
Control:	CTRL [	x	(n)
Decimal:	27	120	(n)
Hexadecimal:		1B	78 (n)

Sets and cancels near letter quality (NLQ) print. n specifies whether NLQ printing is set or cancelled as follows:

- n = 1 or 49: Set NLQ
- n = 0 or 48: Cancel NLQ

The character following ESC is the lowercase letter "x".

*Note:* Near letter quality printing is available only in 10, 12, and 15 pitch.

*Example*

```
REM SELECT NLQ PRINT
LPRINT CHR$(27);"x";CHR$(1);
LPRINT "This is NLQ print."
REM CANCEL NLQ, SELECT DRAFT PRINT
LPRINT CHR$(27);"x";CHR$(0);
LPRINT "This is draft print."
```



ESC G	Double Strike	
ASCII:	ESC	G
Control:	CTRL [	G
Decimal:	27	71
Hexadecimal:	1B	47

Starts double-strike printing. Each line is printed with two passes of the printhead. ESC G remains in effect until ESC H, ESC ! (n), ESC Az! (n), or SOH Az! (n) is received.

See BASIC example in ESC H.

ESC H	Cancel Double Strike	
ASCII:	ESC	H
Control:	CTRL [	H
Decimal:	27	72
Hexadecimal:	1B	48

Cancels double-strike set with ESC G, ESC ! (n), SOH Az! (n), or ESC Az! (n).

### *Example*

```
REM SET DOUBLE STRIKE PRINTING
LPRINT CHR$(27);"G";
LPRINT "In double strike mode."
REM CANCEL DOUBLE STRIKE PRINTING
LPRINT CHR$(27);"H";
LPRINT "Now in single strike mode."
```

ESC E	Emphasized Mode (Bold Strike), ON	
ASCII:	ESC	E
Control:	CTRL [	E
Decimal:	27	69
Hexadecimal:	1B	45

Begins emphasized printing. All characters following this command are printed in bold strike. See BASIC example under ESC F.

ESC F		Emphasized Mode (Bold Strike), OFF	
ASCII:	ESC	F	
Control:	ctrl [	F	
Decimal:	27	70	
Hexadecimal:	1B	46	

Cancels emphasized printing (bold strike) set with ESC E, ESC ! (n), ESC Az! (n), or SOH Az! (n).

### Example

```
REM PRINT IN BOLD STRIKE
LPRINT CHR$(27);"E";
LPRINT "Now printing in bold strike."
REM CANCEL BOLD STRIKE
LPRINT CHR$(27);"F";
LPRINT "Now printing in single strike."
```

ESC -		Set/Cancel Underline	
ASCII:	ESC	-	(n)
Control:	CTRL [	-	(n)
Decimal:	27	45	(n)
Hexadecimal:	1B	2D	(n)

Sets and cancels the underline function. n specifies whether the function is set or cancelled as follows:

- n = 1 or 49: Set underline function
- n = 0 or 48: Cancel underline function

### Example

```
REM SET UNDERLINE FUNCTION
LPRINT CHR$(27);"-";CHR$(1);
LPRINT "Underline function is on."
REM CANCEL UNDERLINE FUNCTION
LPRINT CHR$(27);"-";CHR$(0);
LPRINT "Underline function is now off."
```

ESC S		Set Subscript/Superscript	
ASCII:	ESC	S	(n)
Control:	CTRL [	S	(n)
Decimal:	27	83	(n)
Hexadecimal:	1B	53	(n)

Prints characters following this control command as subscript or superscript characters. *n* specifies which is selected as follows:

- *n* = 1 or 49: Select subscript
- *n* = 0 or 48: Select superscript

Subscript or superscript characters are printed at normal height. ESC S remains in effect until ESC T is received. Multiple ESC S (*n*) commands may be sent prior to an ESC T.

*Note:* This function works *only* if Sub/Superscript is enabled from the configuration menu .

ESC T		Cancel Subscript/Superscript	
ASCII:	ESC	T	
Control:	CTRL [	T	
Decimal:	27	84	
Hexadecimal:	1B	54	

Cancels subscript/superscript set by ESC S.

ESC 4		Set Italics	
ASCII:	ESC	4	
Control:	CTRL [	4	
Decimal:	27	52	
Hexadecimal:	1B	34	

Allows most upright draft quality or NLQ style (condensed, bold, enlarged, single/double strike) to be printed in italics.

Epson italic characters reside in the upper half of the Epson character sets. ESC 4 causes this upper half to be mapped to the lower bytes.

ESC 5		Cancel Italics	
-------	--	----------------	--

ASCII:	ESC	5
Control:	CTRL [	5
Decimal:	27	53
Hexadecimal:	1B	35

Cancels italics. Print returns to previous upright style.

## TABS

ESC D		Set Multiple Horizontal Tabs		
ASCII:	ESC	D	(n1)...(n32)	NUL
Control:	CTRL [	D	(n1)...(n32)	CTRL @
Decimal:	27	68	(n1)...(n32)	0
Hexadecimal:	1B	44	(n1)...(n32)	00

Sets multiple horizontal tabs. A maximum of 32 tabs may be set with one command. Note that this control command is terminated with a null byte.

This command clears all existing horizontal tabs. Therefore, to add one tab, you must include all existing tabs plus the new one.

ESC D only sets the tabs. The Horizontal Tab control code, HT, causes the printer to tab to each subsequent tab.

n denotes the character position of each tab. The valid range for n is from 1 to one less than the right margin minus the left margin. Send the values of n in ascending order. An out of order tab value is interpreted as a terminator.

The tabs are set relative to the left margin. An n value of 1 sets the tab one character to the right of the left margin. A maximum value of n sets the tab one character to the left of the right margin. Therefore, n is the character position relative to the left margin, not the actual column number.

The following shows the location of tabs for various values of n.

Column	1	2	3	4	5	6	7	8	9	10
Margins		L							R	
n=1			T							
n=4						T				
n=6								T		

### Example

```
REM SET HORIZONTAL TABS TO COLS 6, 12 & 30
LPRINT CHR$(27);"D";CHR$(6);CHR$(12);
LPRINT CHR$(30);CHR$(0);
```

HT	Horizontal Tab
ASCII: HT Control: CTRL I Decimal: 9 Hexadecimal: 09	

Causes the printer to tab to the next tab setting set by control command ESC D or to the default tab (every 8 columns) if ESC D has not been sent. If no tabs exist to the right of the current column, HT is ignored.

VT	Vertical Tab
ASCII: VT Control: CTRL K Decimal: 11 Hexadecimal: 0B	

Causes the printer to print the data stored in the print buffer, then tab to the next tab setting set by ESC B or ESC b. If no tabs exist past the current position on the page, VT performs the same function as linefeed (LF). If Auto Carriage Return (CR on LF) is enabled, a carriage return is performed after VT.

ESC B		Set Multiple Vertical Tabs		
<i>ASCII:</i>	ESC	B	(n1)...(n16)	NUL
<i>Control:</i>	CTRL [	B	(n1)...(n16)	CTRL @
<i>Decimal:</i>	27	66	(n1)...(n16)	0
<i>Hexadecimal:</i>	1B	42	(n1)...(n16)	00

Sets vertical tabs to the specified lines. Note that this control command is terminated with a null byte. *n* denotes the line number for each tab. The valid entries for *n* are from 2 to the bottom line on the page, as specified by the form length setting. Send the values of *n* in ascending order. An out of order tab value is interpreted as a terminator.

The tab positions set by ESC B are the same as those set by ESC b (0), vertical tab channel zero.

ESC B and ESC b clear all existing vertical tabs. Therefore, to add one tab, you must include all existing tabs, plus the new one. Use ESC B or ESC b to set the tabs. Use the Vertical Tab control code, VT, to cause the printer to tab to each subsequent tab.

### Example

```
REM SET VERTICAL TABS TO LINES 5 TO 10
LPRINT CHR$(27);"B";CHR$(5);CHR$(10);CHR$(0);
```

ESC b		Set Vertical Tab Channel			
<i>ASCII:</i>	ESC	b	(m)	(n1)...(n16)	NUL
<i>Control:</i>	CTRL [	b	(m)	(n1)...(n16)	CTRL @
<i>Decimal:</i>	27	98	(m)	(n1)...(n16)	0
<i>Hexadecimal:</i>	1B	62	(m)	(n1)...(n16)	00

Sets vertical tabs to the specified lines for the vertical tab Channel *m*. Note that this control sequence is terminated with a null byte. *m* denotes the tab channel. The valid entries for *m* are 0 to 7. *n* denotes the line number for each tab. The valid entries for *n* are from 2 to the bottom line on the page, as specified by the form length setting. Send the values of *n* in ascending order. An out of order tab value is interpreted as a terminator.

*Note:* The tab positions for Channel 0 can also be set with ESC B.

ESC B and ESC b clear all existing vertical tabs. Therefore, to add one tab, you must include all existing tabs, plus the new one. Use ESC B or ESC b to set the tabs. Use the Vertical Tab control code, VT, to cause the printer to tab to each subsequent tab.

ESC /		Select Vertical Tab Channel	
<i>ASCII:</i>	ESC / (n)		
<i>Control:</i>	CTRL [ / (n)		
<i>Decimal:</i>	27 47 (n)		
<i>Hexadecimal:</i>	1B 2F (n)		

Selects one of eight vertical tab channels as active. All subsequent VT commands use the channel selected by this command. Valid entries for n are 0 to 7. The default value is 0.





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# IBM Proprinter Control Commands

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This section describes the control codes and control commands you can use while the printer is in IBM Proprinter XL emulation mode.

Before using these commands, read the section entitled "Control Commands—An Introduction." It describes the typographic conventions used in this section and other information needed to send these commands in the correct format.

## INDEX OF CONTROL CODES AND COMMANDS

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*Margins*

Set Horizontal Margins	ESC X (n1)(n2)	249
Skip Over Perforation (Sets Bottom Margin)	ESC N (n)	250
Cancel Skip Over Perforation	ESC O	250

---

*Miscellaneous*

Carriage Return	CR	251
Bell	BEL	251
Backspace	BS	251
Linefeed	LF	252
Auto Linefeed	ESC 5 (n)	252
Form Feed	FF	252
Top of Form	ESC 4	253
Cancel Data in Print Buffer	CAN	253
Select Printer	DC1	253
Deselect Printer	ESC Q (22)	254
Deselect Printer	DC3	254

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*Print Direction*

Unidirectional or Bidirectional	ESC U (n)	255
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*Print Style*

Condensed Pitch	SI or ESC SI	256
Cancel Condensed Pitch	DC2	257
Enlarged Pitch	SO or ESC SO	258
Cancel Enlarged Pitch	DC4	259
Set/Cancel Enlarged Pitch	ESC W (n)	260
Set 12 Pitch	ESC :	261

Set/Cancel NLQ	ESC I (n)	262
Set NLQ	ESC G	262
Cancel NLQ	ESC H	262
Emphasized Mode (Bold Strike) ON	ESC E	262
Emphasized Mode (Bold Strike) OFF	ESC F	263
Set/Cancel Underline	ESC - (n)	263
Set Subscript/Superscript	ESC S (n)	264
Cancel Subscript/Superscript	ESC T	264

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*Tabs*

Set Multiple Horizontal Tabs	ESC D (n1)...(n32) NUL	265
Horizontal Tab	HT	266
Vertical Tab	VT	266
Set Multiple Vertical Tabs	ESC B (n1)...(n16) NUL	267
Set Tabs to Power On Settings	ESC R	267

## ALPHABETICAL SUMMARY

Command	Function	Page	Command	Function	Page
BEL	Bell	239	ESC G	Set NLQ	250
BS	Backspace	239	ESC H	Cancel NLQ	250
CAN	Cancel Data in Print Buffer	241	ESC I	Set/Cancel NLQ	250
CR	Carriage Return	239	ESC J	n/216 Inch Line Spacing	236
DC1	Select Printer	241	ESC K	Single-Density Graphics	231
DC2	Cancel Condensed Pitch	245	ESC L	Double-Density Graphics	232
DC3	Deselect Printer on Serial Port	242	ESC N	Skip Over Perforation	238
DC4	Cancel Enlarged Pitch	247	ESC O	Cancel Skip Over Perforation	238
ESC -	Set/Cancel Underline	251	ESC Q (22)	Deselect Printer	242
ESC 0	1/8 Inch Line Spacing	235	ESC R	Set Tabs to Power On Settings	255
ESC 1	7/72 Inch Line Spacing	235	ESC S	Set Subscript/Superscript	252
ESC 2	Start Text Line Spacing		ESC SI	Condensed Pitch	244
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ESC 3	n/216 Inch Line Spacing	236	ESC T	Cancel Subscript/Superscript	252
ESC 4	Set Top of Form	241	ESC U	Unidirectional/Bidirectional Printing	243
ESC 5	Auto Linefeed	240	ESC W	Set/Cancel Enlarged Pitch	248
ESC 6	Select IBM Character Set #2	227	ESC X	Set Horizontal Margins	237
ESC 7	Select IBM Character Set #1	227	ESC Y	Double-Density Graphics	232
ESC :	Set 12 Pitch	249	ESC Z	Quad-Density Graphics	234
ESC A	n/72 Inch Line Spacing	235	ESC \	All Characters Character Set	227
ESC B	Set Multiple Vertical Tabs	255	ESC ^	Next Character From All	
ESC C	Set Length of Form by Line	229		Characters Set	228
ESC C NUL	Set Length of Form in Inches	230	FF	Form Feed	240
ESC D	Set Multiple Horizontal Tabs	253	HT	Horizontal Tab	254
ESC E	Emphasized Mode, (Bold Strike) ON	250	LF	Linefeed	240
ESC F	Emphasized Mode, (Bold Strike) OFF	251	SI	Condensed Pitch	244
			SO	Enlarged Pitch	246
			VT	Vertical Tab	254

## UNAVAILABLE IBM PROPRINTER CONTROL COMMANDS

The following commands are not available in IBM emulation mode:

- ESC = Downloaded Character Font
- ESC [ @ Double High/Double Wide Printing
- ESC \_ Continuous Overscore
- ESC P Proportional Printing

The IBM Download Character Font command, ESC =, can be performed by the equivalent universal control command SOH Az&.

## CHARACTER SETS

ESC 6			Select IBM Character Set #2	
ASCII:	ESC	6		
Control:	CTRL [	6		
Decimal:	27	54		
Hexadecimal:	1B	36		

This command causes the printer to print with the IBM Character Set #2.

See Appendix D for charts of character sets.

ESC 7			Select IBM Character Set #1	
ASCII:	ESC	7		
Control:	CTRL [	7		
Decimal:	27	55		
Hexadecimal:	1B	37		

This command causes the printer to print with the IBM Character Set #1.

See Appendix D for charts of character sets.

ESC \			All Character Character Set*	
ASCII:	ESC	\	(n1)	(n2)
Control:	CTRL [	\	(n1)	(n2)
Decimal:	27	92	(n1)	(n2)
Hexadecimal:	1B	5C	(n1)	(n2)

Prints a number of characters from an All Character Set, then returns to the character set in use prior to receipt of the ESC \ command.

n1 and n2 specify the number of succeeding characters to be printed from this set. The total number of characters to be printed from an All Character Character Set is equal to "n1 + (n2 x 256)". An All Character Character Set is constructed from an IBM Code Page. (See Appendix D.)

---

\* ESC \ enables you to print continuously from an All Character Character Set. ESC ^ is valid for printing one character only. Both commands enable printing of characters for data bytes normally recognized as control codes. See Appendix D for charts of character sets.

An All Character Character Set includes printable characters for data byte values from 0 to 31 and 128 to 159 decimal (00 to 1F hex and 80 to 9F hex). No control code functions are performed when ESC \ is in effect.

*Example*

```
REM PRINT NEXT 130 CHARACTERS FROM ALL CHARACTERS SET
LPRINT CHR$(27);"\";CHR$(130);CHR$(0);
```

ESC ^		Print One Character From All Character Set*
ASCII:	ESC	^
Control:	CTRL [	^
Decimal:	27	94
Hexadecimal:	1B	5E

Prints the next character from an All Character Character Set, then returns to the character set in use prior to receipt of the ESC ^ command.

*Example*

```
REM PRINT NEXT CHARACTERS FROM ALL CHARACTERS SET
LPRINT CHR$(27);"^";CHR$(206);
RESULTS:PRINTS ö
```

---

\* ESC \ enables you to print continuously from an All Characters Character Set. ESC ^ is valid for printing one character only. Both commands enable printing of characters for data bytes normally recognized as control codes. See Appendix D for charts of character sets.



## FORM LENGTH

ESC C				Length of Form in Lines
<i>ASCII:</i>	ESC	C	(n)	
<i>Control:</i>	CTRL [	C	(n)	
<i>Decimal:</i>	27	67	(n)	
<i>Hexadecimal:</i>	1B	43	(n)	

Sets form length to n number of lines. n must be from 1 to 255. The default setting is 66 lines. The current form position becomes the top of form when the printer receives this command.

If the bottom margin was previously set by the Skip Over Perforation command (ESC N), the Length of Form in Lines command cancels the bottom margin setting. Therefore, to re-establish the bottom margin after the Length of Form in Lines command is set, send another Skip Over Perforation command.

Form length is stored as an absolute length equal to the line spacing multiplied by the specified number of lines. That form length remains in effect even if the line spacing is changed.

### *Example*

```
REM SET FORM LENGTH TO 50 LINES
LPRINT CHR$(27);"C";CHR$(50);
```

ESC C NUL				Length of Form in Inches
ASCII:	ESC	C	NUL	(n)
Control:	CTRL [	C	NUL	(n)
Decimal:	27	67	0	(n)
Hexadecimal:	1B	43	00	(n)

Sets form length to an integer number of inches *n*. *n* must be from 1 to 151. (See Note below.) The default is 11 in. The current form position becomes the top of form when the printer receives this command.

If the bottom margin was previously set by the Skip Over Perforation command (ESC N), the Length of Form in Inches command cancels the bottom margin setting. Therefore, to re-establish the bottom margin after Length of Form in Inches is set, send another Skip Over Perforation command.

*Note:* The IBM Proprinter allows a form length range of  $1 < n < 180$  in. The IBM emulation in the 4100 printer allows a range of  $1 < n < 151$  in. An out of range value is ignored.

*Example*

```
REM SET FORM LENGTH TO 10 LINES
LPRINT CHR$(27);"C";CHR$(10);
```

## GRAPHICS

ESC K			Single-Density Graphics		
<i>ASCII:</i>	ESC	K	(n1)	(n2)	(d1)...(d816)
<i>Control:</i>	CTRL [	K	(n1)	(n2)	(d1)...(d816)
<i>Decimal:</i>	27	75	(n1)	(n2)	(d1)...(d816)
<i>Hexadecimal:</i>	1B	4B	(n1)	(n2)	(d1)...(d816)

Causes the printer to print single-density-graphics dot columns. Single-density graphics are printed 60 dot columns per horizontal inch.

n1 and n2 specify the number of dot columns (data bytes) to reserve for graphics. The maximum number of dot columns per line for single-density graphics is 816. n1 and n2 are calculated as follows:

$$n1 = X \text{ MOD } 256$$

$$n2 = \text{INT}(X/256)$$

where X equals the number of dot columns to reserve. For example, if the number of dot columns is 80:

$$n1 = 80 \text{ MOD } 256 = 80$$

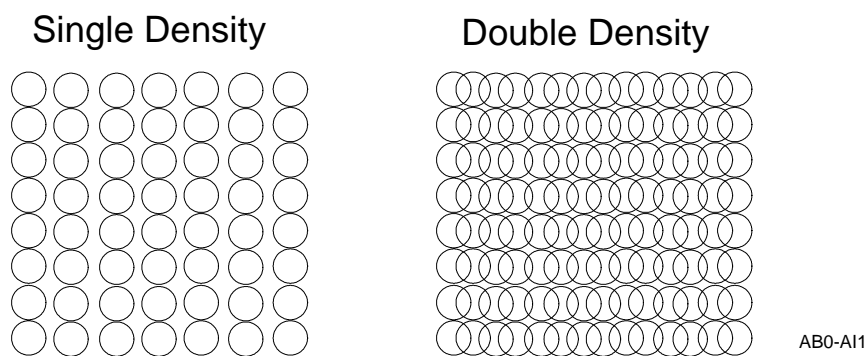
$$n2 = \text{INT}(80/256) = 0$$

d1...d816 are decimal numbers from 0 to 255, each representing a dot column. Each decimal number has a corresponding 8-bit binary expression. The bits set to logic 1 in the binary expression correspond to the printhead pins that fire to create dots in each dot column. If a bit is set, the corresponding pin fires. If it is not set, the corresponding pin does not fire. See the figures and examples of single-density graphics in the Epson FX-100 Control Command section.

ESC L or ESC Y			Double-Density Graphics		
<i>ASCII:</i>	ESC	L	(n1)	(n2)	(d1)...(d1632)
<i>Control:</i>	CTRL [	L	(n1)	(n2)	(d1)...(d1632)
<i>Decimal:</i>	27	76	(n1)	(n2)	(d1)...(d1632)
<i>Hexadecimal:</i>	1B	4C	(n1)	(n2)	(d1)...(d1632)
<i>ASCII:</i>	ESC	Y	(n1)	(n2)	(d1)...(d1632)
<i>Control:</i>	CTRL [	Y	(n1)	(n2)	(d1)...(d1632)
<i>Decimal:</i>	27	89	(n1)	(n2)	(d1)...(d1632)
<i>Hexadecimal:</i>	1B	59	(n1)	(n2)	(d1)...(d1632)

Causes the printer to print double-density graphics. Double-density graphics are printed 120 dot columns per horizontal in.

The following illustrates the difference between single-density and double-density graphics:



Use ESC L to print double-density graphics at double-density speed.

Use ESC Y to print double-density graphics at single-density speed. ESC Y causes alternate dots to be skipped during printing.

The maximum number of dot columns that can be reserved per line in double-density graphics is 1632.

*Note:*  $n/216$  vertical line spacing may be used in graphic printing.  $n/216$  in. line spacing is approximated using  $1/144$  in. steps. Maximum local and cumulative error is  $-1/216$  in.

The operation of double-density graphics and quad density is the same as single density. For more information, refer to the description of the Single-Density Graphics command (ESC K).

*Example*

```
REM PRINT 2 SOLID BARS 150 DOT PATTERNS IN  
REM LENGTH USING DOUBLE DENSITY GRAPHICS  
FOR I = 1 TO 2  
LPRINT CHR$(27);"L";CHR$(150);CHR$(0);  
FOR J = 1 TO 150  
LPRINT CHR$(255);  
NEXT J  
LPRINT  
NEXT I  
END
```

ESC Z			Quad-Density Graphics		
<i>ASCII:</i>	ESC	Z	(n1)	(n2)	(d1)...(d3264)
<i>Control:</i>	CTRL [	Z	(n1)	(n2)	(d1)...(d3264)
<i>Decimal:</i>	27	90	(n1)	(n2)	(d1)...(d3264)
<i>Hexadecimal:</i>	1B	5A	(n1)	(n2)	(d1)...(d3264)

Causes the printer to print quadruple-density graphics. Quadruple-density graphics are printed in synthesized 240 dot columns per horizontal in. The maximum number of dot columns that can be reserved per line in quad density graphics is 3264.

The printer prints half as many dot columns as it receives. Adjacent columns are paired, and if corresponding bits in either dot column are set, a pin is fired to create a dot.

The arguments for quad-density graphics are the same as the Single-Density Graphics command (ESC K).

*Example*

```
REM PRINT 2 SOLID BARS 150 DOT PATTERNS IN
REM LENGTH USING QUAD DENSITY GRAPHICS
FOR I = 1 TO 2
  LPRINT CHR$(27);"Z";CHR$(150);CHR$(0);
  FOR J = 1 TO 150
    LPRINT CHR$(255);
  NEXT J
  LPRINT
NEXT I
END
```

## LINE SPACING

ESC 1			7/72 inch
ASCII:	ESC	1	
Control:	CTRL [	1	
Decimal:	27	49	
Hexadecimal:	1B	31	

Sets all subsequent line spacing at 7/72 in. (10.3 lines per in.).

ESC Ø			1/8 inch
ASCII:	ESC	Ø	
Control:	CTRL [	Ø	
Decimal:	27	48	
Hexadecimal:	1B	30	

Sets all subsequent line spacing at 1/8 in. (8 lines per in.).

ESC A			n/72 inch
ASCII:	ESC	A	(n)
Control:	CTRL [	A	(n)
Decimal:	27	65	(n)
Hexadecimal:	1B	41	(n)

Sets all subsequent line spacing at n/72 in. The valid entries for n are 1 to 85.

ESC A only sets the line spacing. ESC 2 causes the specified line spacing to start. Linefeeds (LF) sent before ESC 2 is spaced at the previously set line spacing.

ESC 2			Start Text Line Spacing
ASCII:	ESC	2	
Control:	CTRL [	2	
Decimal:	27	50	
Hexadecimal:	1B	32	

Begins text line spacing set by ESC A. If ESC A has not been sent, line spacing is 6 lines per in.

ESC 3 or ESC J				n/216 inch
ASCII:	ESC	3	(n)	
Control:	CTRL [	3	(n)	
Decimal:	27	51	(n)	
Hexadecimal:	1B	33	(n)	
ASCII:	ESC	J	(n)	
Control:	CTRL [	J	(n)	
Decimal:	27	74	(n)	
Hexadecimal:	1B	4A	(n)	

Sets line spacing at n/216 in. The valid entries for n are 1 to 255.

n/216 in. line spacing is approximated using 1/144 in. steps. Maximum local and cumulative error is - 1/216 in.

- ESC 3 (n) causes all subsequent line spacing to be set at n/216 in.
- ESC J (n) prints all data in the print buffer, clears the print buffer, then advances the paper n/216 in., one time only. If Auto Carriage Return (CR on LF) is enabled, ESC J (Ø) causes a carriage return to be performed after the paper advances the amount specified by n. The command ESC J (Ø) is equivalent to a carriage return.

*Note:* n/216 in. line spacing is called "Graphics Line Spacing" by some manufacturers. Use a line spacing of 24/216 in. for bit-image graphics using eight bits.

### Example

```
REM LPRINT "Prints buffer & advances paper 1 in."
LPRINT CHR$(27);CHR$(74);CHR$(216);
```



## MARGINS

ESC X		Set Horizontal Margins		
<i>ASCII:</i>	ESC	X	(n1)	(n2)
<i>Control:</i>	CTRL [	X	(n1)	(n2)
<i>Decimal:</i>	27	88	(n1)	(n2)
<i>Hexadecimal:</i>	1B	58	(n1)	(n2)

Sets the left margin to Column n1 and the right margin to Column n2. Specify margins in character positions, at the pitch currently in use. Margins are stored in absolute displacements from the left edge of the paper.

If n1 is 0, the current left margin is used. If n2 is 0, the current right margin is used.

n1 must be at least one character position less than n2.

n2 must be 255 or less. If 255 is specified for the right margin, the maximum right margin is set.

Use a CR immediately after ESC X to establish the printhead position relative to the new margin settings.

ESC N		Skip Over Perforation	
ASCII:	ESC	N	(n)
Control:	CTRL [	N	(n)
Decimal:	27	78	(n)
Hexadecimal:	1B	4E	(n)

Sets the bottom margin to n number of lines. n must be from 1 to 255.

When the form length is changed by using the Length of Form by Lines command

(ESC C) or the Length of Form in Inches Command (ESC C NUL), the bottom margin setting is cancelled. To regain the bottom margin setting, use ESC N following either ESC C or ESC C (NUL).

*Example*

```
REM SET FORM LENGTH TO 55 LINES AND RESET
REM BOTTOM MARGIN TO 3 LINES
LPRINT CHR$(27);"C";CHR$(55);
LPRINT CHR$(27);"N";CHR$(3);
```

ESC O		Cancel Skip Over Perforation	
ASCII:	ESC	O	
Control:	CTRL [	O	
Decimal:	27	79	
Hexadecimal:	1B	4F	

Cancels the bottom margin setting set with ESC N.

## MISCELLANEOUS

CR	Carriage Return
ASCII: CR Control: CTRL M Decimal: 13 Hexadecimal: 0D	

Prints any data stored in the print buffer, and sets the current column position to the left margin.

If Auto Linefeed (LF on CR) is enabled, or if ESC 5 is sent before CR, a linefeed is performed after the carriage return.

BEL	Bell
ASCII: BEL Control: CTRL G Decimal: 7 Hexadecimal: 07	

Sounds the beeper once, for approximately 0.1 second.

BS	Backspace
ASCII: BS Control: CTRL H Decimal: 8 Hexadecimal: 08	

Prints any data in the print buffer, then backs up one column for the next starting position. This is used to create overstrike characters.

If you have changed the character pitch before sending the BS control code, the distance the printer backs up may be inaccurate.

LF	Linefeed
ASCII: LF Control: CTRL J Decimal: 10 Hexadecimal: 0A	

Prints any data in the print buffer and advances the paper one line. If Auto Carriage Return (CR on LF) is enabled, a carriage return is performed after the linefeed.

This control code cancels control code SO.

ESC 5	Auto Linefeed
ASCII: ESC 5 (n) Control: CTRL [ 5 (n) Decimal: 27 53 (n) Hexadecimal: 1B 35 (n)	

Sets and cancels automatic linefeed (LF on CR). n specifies whether the function is set or cancelled as follows:

- n = 1: Set automatic linefeed
- n = 0: Cancel automatic linefeed

When automatic linefeed (LF on CR) is set, the printer does a linefeed each time a carriage return is received.

ESC 5 overrides the automatic linefeed option set from the configuration menu.

FF	Form Feed
ASCII: FF Control: CTRL L Decimal: 12 Hexadecimal: 0C	

Prints any data in the print buffer and advances the paper to the next top of form. A carriage return is performed after the form feed.

This control code cancels control code SO.

ESC 4	Set Top of Form
ASCII: ESC 4	
Control: CTRL [ 4	
Decimal: 27 52	
Hexadecimal: 1B 34	

Sets the current paper position as the top of form.

CAN	Cancel Data in Print Buffer
ASCII: CAN	
Control: CTRL X	
Decimal: 24	
Hexadecimal: 18	

Cancels all data currently in the print buffer.

If Auto Carriage Return (CR on LF) is enabled, the left margin becomes the current print position.

DC1	Select Printer
ASCII: DC1	
Control: CTRL Q	
Decimal: 17	
Hexadecimal: 11	

Sets the printer to accept data from the computer after it has been deselected by ESC Q (22) in the serial mode. This code does not place the printer on line if it has been placed off line by pressing **ON LINE**. DC1 is the X-ON character.

See Appendix B for details regarding software handshaking.

ESC Q (22)				Deselect Printer
ASCII:	ESC	Q	(22)	
Control:	CTRL [	Q	(22)	
Decimal:	27	81	22	
Hexadecimal:	1B	51	16	

Sets the printer so it will not accept data from the computer. This control command is intended for diagnostic purposes only. The printer remains in the off line state until Select Printer (DC1) is received, and cannot be reselected by pressing **ON LINE**.

DC3		Deselect Printer on Serial Port	
ASCII:	DC3		
Control:	CTRL S		
Decimal:	19		
Hexadecimal:	13	07	

Deselects printer when used with a serial interface.

Treated as a null on the parallel interface. On the serial interface, the printer sends this control code to indicate its buffer is full. DC3 is the X-OFF character.

See Appendix B for details regarding software handshaking.

## PRINT DIRECTION

ESC U		Unidirectional/Bidirectional Printing	
<i>ASCII:</i>	ESC	U	(n)
<i>Control:</i>	CTRL [	U	(n)
<i>Decimal:</i>	27	85	(n)
<i>Hexadecimal:</i>	1B	55	(n)

Causes the printer to print unidirectionally or bidirectionally. n indicates which is selected as follows:

- n = 1 or 49: Unidirectional printing
- n = 0 or 48: Bidirectional printing

When unidirectional printing is selected, data is printed only when the printhead is moving from left to right. Printing this way improves vertical character alignment.

When bidirectional printing is selected, data is printed when the printhead is moving in both directions. This is the default print mode.

*Note:* If set to ON, "PRINT STYLE, Bi-Directional Graphics / NLQ" in the configuration menu overrides unidirectional printing.

## PRINT STYLE

SI or ESC SI		Condensed Pitch
ASCII:	SI	
Control:	CTRL O	
Decimal:	15	
Hexadecimal:	0F	
ASCII:	ESC	SI
Control:	CTRL [	CTRL O
Decimal:	27	15
Hexadecimal:	1B	0F

Increases character pitch according to the table below. Increasing character pitch allows more characters to be printed per line. ESC SI duplicates the function of the SI command.

Current Pitch	After SI or ESC SI
5.0	8.57
6.0	9.1
7.5	9.1
10.0	17.14
12.0	18.2
15.0	18.2

Current character pitches of 8.33, 8.57, 9.1, 16.67, 17.14, and 18.2 are unaffected by this command. See DC2, on the following page, to cancel condensed pitch.

### *Example*

```
REM SET 12 PITCH,  
REM THEN CHANGE TO 10 PITCH.  
REM AFTER THAT CHANGE TO 17.14 PITCH, AS FOLLOWS  
LPRINT CHR$(27);CHR$(58);  
LPRINT "Now printing in 12 cpi."  
LPRINT CHR$(18);  
LPRINT "Now printing in 10 cpi."  
LPRINT CHR$(15);  
LPRINT "Now printing in 17.14 cpi."  
LPRINT CHR$(13);
```



DC2	Cancel Condensed Pitch
ASCII: DC2	
Control: CTRL R	
Decimal: 18	
Hexadecimal: 12	

Cancels condensed pitch set by SI or ESC SI. Returns to the pitch that was set prior to using SI or ESC SI. Also, cancels 12 pitch set by ESC : and resets to 10 pitch.

Previous Pitch	New Pitch (After SI or ESC SI)	After DC2	Previous Pitch	New Pitch (After ESC)	After DC2
5.0	8.33	5.0	Any	12	10
6.0	9.1	6.0			
7.5	9.1	7.5			
10.0	16.67	10.0			
12.0	18.2	12.0			
15.0	18.2	15.0			

*Note:* To reset 7.5 or 15.0 pitch, use universal control command SOH Az!.

### *Example*

```
REM CHANGE FROM 10 PITCH TO 17.14 PITCH
LPRINT CHR$(15);
LPRINT "Printing in 17.14 pitch."
REM CANCEL 17.14 PITCH, RETURN TO 10 PITCH
LPRINT CHR$(18);
LPRINT "Printing in 10 pitch."
```

SO or ESC SO		Enlarged Pitch
ASCII:	SO	
Control:	CTRL N	
Decimal:	14	
Hexadecimal:	0E	
ASCII:	ESC	SO
Control:	CTRL [	CTRL N
Decimal:	27	14
Hexadecimal:	1B	0E

Enlarges the currently selected pitch as follows:

Current Pitch	After SO or ESC SO
18.2	9.1
17.14	8.57
16.67	8.33
15.0	7.5
12.0	6.0
10.0	5.0

See the BASIC example under DC4.

SO causes the enlarged pitch to remain in effect for one line only, or until one of the following is received:

- CR VT SOH A z ! (n)
- CAN ESC W (0) ESC A z ! (n)
- LF ESC W (48)
- FF DC4

*Note:* Enlarged pitch is called "Double Wide Printing" by some manufacturers. This command is not valid when NLQ printing is selected.

DC4	Cancel Enlarged Pitch
ASCII: DC4 Control: CTRL T Decimal: 20 Hexadecimal: 14	

Cancels enlarged pitch set with command SO or ESC SO. See the table below.

Pitch Set with SO or ESC SO	After DC4
9.1	18.2
8.57	17.14
8.33	16.67
7.5	15.0
6.0	12.0
5.0	10.0

This command does not cancel enlarged pitches set with ESC W (n), ESC ! (n), SOH A z ! (n), or ESC A z ! (n).

### *Example*

```

REM SET 12 PITCH,
REM THEN CHANGE TO 10 PITCH.
REM AFTER THAT ENLARGE TO 5 PITCH.
REM FINALLY, CANCEL ENLARGED PITCH
REM TO RETURN TO 10 PITCH, AS FOLLOWS
LPRINT CHR$(27);CHR$(58);
LPRINT "Now printing in 12 cpi."
LPRINT CHR$(18);
LPRINT "Now printing in 10 cpi."
LPRINT CHR$(14);
LPRINT "Now printing in 5 cpi."
LPRINT CHR$(20);
LPRINT "Now printing in 10 cpi again."
LPRINT CHR$(13);

```

ESC W		Set/Cancel Enlarged Pitch	
<i>ASCII:</i>	ESC W	(n)	
<i>Control:</i>	CTRL [ W	(n)	
<i>Decimal:</i>	27 87	(n)	
<i>Hexadecimal:</i>	1B 57	(n)	

Sets and cancels enlarged pitch. n specifies whether the function is set or cancelled:

- n = 1 or 49: Set enlarged pitch
- n = 0 or 48: Cancel enlarged pitch

Setting enlarged pitch causes the currently selected pitch to become enlarged as follows:

Current Pitch	After ESC W (1)	Previous Pitch	After ESC W (0)
18.2	9.1	9.1	18.2
17.14	8.57	8.57	17.14
16.67	8.33	8.33	16.67
15.0	7.5	7.5	15.0
12.0	6.0	6.0	12.0
10.0	5.0	5.0	10.0

ESC W (1) or ESC W (49) causes enlarged pitch to remain in effect until changed by one of the following:

- ESC W (0) ESC A z ! (n)
- ESC W (48) SOH A z ! (n)

*Note:* Enlarged pitch is called "Double Wide Printing" by some manufacturers. This command is not valid when NLQ printing is selected.

*Example*

```

REM SET ENLARGED PITCH
LPRINT CHR$(27);"W";CHR$(1);"This is large."
REM CANCEL ENLARGED PITCH
LPRINT CHR$(27);"W";CHR$(0);"This is small."

```

ESC :			Set 12 Pitch
ASCII:	ESC	:	
Control:	CTRL [	:	
Decimal:	27	58	
Hexadecimal:	1B	3A	

Sets character pitch to 12 pitch. If currently printing in Enlarged Pitch, sets to 6 pitch. Control code DC2 resets to 10 pitch.

Current Pitch	After ESC
18.2	12.0
17.14	12.0
16.67	12.0
15.0	12.0
10.0	12.0
9.1	6.0
8.57	6.0
8.33	6.0
7.5	6.0
5.0	6.0

ESC I				Set/Cancel NLQ
ASCII:	ESC	I	(n)	
Control:	CTRL [	I	(n)	
Decimal:	27	73	(n)	
Hexadecimal:	1B	49	(n)	

Sets and cancels near letter quality (NLQ) print. n specifies whether NLQ printing is set or cancelled as follows:

- n = 1 or 4: Cancel NLQ
- n = 2 or 6: Set NLQ

*Note:* Near letter quality printing is available only in 10, 12, and 15 pitch.

ESC G				Set NLQ
ASCII:	ESC	G		
Control:	CTRL [	G		
Decimal:	27	71		
Hexadecimal:	1B	47		

Starts near letter quality (NLQ) printing.

*Note:* Near letter quality printing is available only in 10, 12, and 15 pitch.

ESC H				Cancel NLQ
ASCII:	ESC	H		
Control:	CTRL [	H		
Decimal:	27	72		
Hexadecimal:	1B	48		

Cancels near letter quality (NLQ) printing set with ESC G.

ESC E				Emphasized Mode (Bold Strike), ON
ASCII:	ESC	E		
Control:	CTRL [	E		
Decimal:	27	69		
Hexadecimal:	1B	45		

Begins emphasized printing. All characters following this command are printed in bold strike. See BASIC example under ESC F.

ESC F			Emphasized Mode (Bold Strike), OFF
ASCII:	ESC	F	
Control:	CTRL [	F	
Decimal:	27	70	
Hexadecimal:	1B	46	

Cancels emphasized printing (bold strike) set with ESC E, ESC ! (n), ESC Az! (n), or SOH Az! (n).

### Example

```
REM PRINT IN BOLD STRIKE
LPRINT CHR$(27);"E";
LPRINT "Now printing in bold strike."
REM CANCEL BOLD STRIKE
LPRINT CHR$(27);"F";
LPRINT "Now printing in single strike."
```

ESC -				Set/Cancel Underline
ASCII:	ESC	-	(n)	
Control:	CTRL [	-	(n)	
Decimal:	27	45	(n)	
Hexadecimal:	1B	2D	(n)	

Sets and cancels the underline function. n specifies whether the function is set or cancelled as follows:

- n = 1 or 49: Set underline function
- n = 0 or 48: Cancel underline function

### Example

```
REM SET UNDERLINE FUNCTION
LPRINT CHR$(27);"-";CHR$(1);
LPRINT "Underline function is on."
REM CANCEL UNDERLINE FUNCTION
LPRINT CHR$(27);"-";CHR$(0);
LPRINT "Underline function is off."
```

ESC S		Set Subscript/Superscript	
ASCII:	ESC	S	(n)
Control:	CTRL [	S	(n)
Decimal:	27	83	(n)
Hexadecimal:	1B	53	(n)

Prints characters following this control command as subscript or superscript characters. *n* specifies either subscript or superscript:

- *n* = 1 or 49: Select subscript
- *n* = 0 or 48: Select superscript

Subscript or superscript characters are printed at normal height. ESC S remains in effect until ESC T is received. Multiple ESC S (*n*) commands may be sent prior to an ESC T.

*Note:* This function works only if Sub/Superscript is enabled from the configuration menu.

ESC T		Cancel Subscript/Superscript	
ASCII:	ESC	T	
Control:	CTRL [	T	
Decimal:	27	84	
Hexadecimal:	1B	54	

Cancels subscript/superscript set by ESC S.



## TABS

ESC D		Set Multiple Horizontal Tabs		
<i>ASCII:</i>	ESC	D	(n1)...(n32)	NUL
<i>Control:</i>	CTRL [	D	(n1)...(n32)	CTRL @
<i>Decimal:</i>	27	68	(n1)...(n32)	0
<i>Hexadecimal:</i>	1B	44	(n1)...(n32)	00

Sets multiple horizontal tabs. A maximum of 28 tabs may be set with one command. Note that this control command is terminated with a null byte.

This command clears all existing horizontal tabs. Therefore, to add one tab, you must include all existing tabs plus the new one.

ESC D only sets the tabs. The Horizontal Tab control code, HT, causes the printer to tab to each subsequent tab.

n denotes the character position of each tab. The valid range for n is from 1 to one less than the right margin minus the left margin. Send the values of n in ascending order. An out of order tab value is interpreted as a terminator.

The tabs are set relative to the left margin. An n value of 1 sets the tab at the left margin. A maximum value of n sets the tab one character to the left of the right margin. Therefore, n is the character position relative to the left margin, not the actual column number.

The following shows the location of tabs for various values of  $n$ .

[illegible]

*Example*

```
REM SET HORIZONTAL TABS TO COLS 6, 12 & 30
LPRINT CHR$(27);"D";CHR$(6);CHR$(12);
LPRINT CHR$(30);CHR$(0);
```

HT	Horizontal Tab
ASCII: HT Control: CTRL I Decimal: 9 Hexadecimal: 09	

Causes the printer to tab to the next tab setting set by control command ESC D or to the default tab (every 8 columns) if ESC D has not been sent. If no tabs exist to the right of the current column, HT is ignored.

VT	Vertical Tab
ASCII: VT Control: CTRL K Decimal: 11 Hexadecimal: 0B	

Causes the printer to print the data stored in the print buffer, then tab to the next tab setting set by ESC B or ESC b. If no tabs exist past the current position on the page, VT performs the same function as linefeed (LF). If Auto Carriage Return (CR on LF) is enabled, a carriage return is performed after VT.

ESC B		Set Multiple Vertical Tabs		
ASCII:	ESC	B	(n1)...(n16)	NUL
Control:	CTRL [	B	(n1)...(n16)	CTRL @
Decimal:	27	66	(n1)...(n16)	0
Hexadecimal:	1B	42	(n1)...(n16)	00

Sets vertical tabs to the specified lines. Note that this control command is terminated with a null byte. *n* denotes the line number for each tab. The valid entries for *n* are from 2 to the bottom line on the page, as specified by the form length setting. Send the values of *n* in ascending order. An out of order tab value is interpreted as a terminator.

ESC B clears all existing vertical tabs. Therefore, to add one tab, you must include all existing tabs, plus the new one. Use ESC B to set the tabs. Use the Vertical Tab control code, VT, to cause the printer to tab to each subsequent tab.

### Example

```
REM SET VERTICAL TABS TO LINES 5 AND 10
LPRINT CHR$(27);"B";CHR$(5);CHR$(10);CHR$(0);
```

ESC R		Set Tabs to Power On Settings	
ASCII:	ESC	R	
Control:	CTRL [	R	
Decimal:	27	82	
Hexadecimal:	1B	52	

Cancels all vertical and horizontal tab settings. Restores power-on horizontal tab settings (one tab stop every eight positions, starting at Column 9).



---

# DEC LA210

## Control Commands

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This section describes the control codes and control commands you can use while the printer is in DEC LA210 emulation mode.

Before using these commands, read the section entitled "Control Commands—An Introduction." It describes the typographic conventions and other information needed to send these commands in the correct format.

## INDEX OF CONTROL CODES AND COMMANDS

---

### *Character Maps*

Select G0	ESC ( (n)	284
Select G1	ESC ) (n)	285
Select G2	ESC * (n)	285
Select G3	ESC + (n)	285
Map G0 into Lower Data Bytes	SI	286
Map G1 into Lower Data Bytes	SO	286
Map G2 into Lower Data Bytes	ESC n	286
Map G3 into Lower Data Bytes	ESC o	287
Map G1 into Upper Data Bytes	ESC ~	287
Map G2 into Upper Data Bytes	ESC }	287
Map G3 into Upper Data Bytes	ESC	288
Print Next Character From G2	ESC N or SS2 (n)	288
Print Next Character From G3	ESC O or SS3 (n)	289

---

### *Lines Per Inch*

Set Line Spacing	ESC [ (n) z	290
Set 6 Lines Per Inch	ESC [ z or ESC [ Ø z or ESC [ 1 z	290 290 290
Set 8 Lines Per Inch	ESC [ 2 z	290
Set 12 Lines Per Inch	ESC [ 3 z	290
Set 2 Lines Per Inch	ESC [ 4 z	290
Set 3 Lines Per Inch	ESC [ 5 z	290
Set 4 Lines Per Inch	ESC [ 6 z	290

---

*Margins*

Left Margin	ESC [ (n) s or ESC [ (n) ; Ø s	291 291
Right Margin	ESC [ ; (n) s or ESC [ Ø ; (n) s	291 291
Left and Right Margin	ESC [ (n1) ; (n2) s	292
Top Margin	ESC [ (n) r	293
Bottom Margin	ESC [ ; (n) r	294
Top and Bottom Margin	ESC [ (n1) ; (n2) r	294
Set Print Area	ESC [ (n1) ; (n2) " s	295

---

*Miscellaneous*

Enable Linefeed/Newline	ESC [ 2 Ø h	296
Disable Linefeed/Newline	ESC [ 2 Ø l	296
Carriage Return	CR	296
Enable Carriage Return/Newline	ESC [ ? 4 Ø h	297
Disable Carriage Return/Newline	ESC [ ? 4 Ø l	297
Enable Auto Wraparound	ESC [ ? 7 h	297
Disable Auto Wraparound	ESC [ ? 7 l	297
Form Length	ESC [ (n) t	297
No Form Mode	ESC [ Ø t	298
Bell	BEL	299
Cancel	CAN	299
Enable C1 Control Codes	ESC SP 7	299
Disable C1 Control Codes	ESC SP 6	299
Define Answer Back Message	ESC P 1 v (h1)...(h30)	301
Return Answer Back Message	ENQ	301
Device Control String	DCS 1 v (h1)...(h30)	302

String Terminator	ESC \ or ST	302 302
Control Sequence Introducer	CSI	302
<hr/> <i>Graphics</i>		
Graphics	ESC P (n) q (d1)...(dx)	303
<hr/> <i>Paper Motion</i>		
Index	ESC D or IND	308 308
Linefeed with Carriage Return	ESC E	308
Next Line	NEL	308
Advance Paper 1/12 Inch	ESC K or PLD	309 309
Linefeed	LF	309
Advance to Line n	ESC [ (n) d	310
Advance n Lines	ESC [ (n) e	310
Form Feed	FF	310
<hr/> <i>Pitch</i>		
Select 18.2 Pitch	ESC [ 1 8 w	311
Select 16.67 Pitch	ESC [ 4 w	311
Select 15.0 Pitch	ESC [ 3 w	311
Select 12.0 Pitch	ESC [ 2 w	311
Select 10.0 Pitch	ESC [ Ø w or ESC [ w or ESC [ 1 w	311 311 311
Select 9.1 Pitch	ESC [ 9 w	311
Select 8.33 Pitch	ESC [ 8 w	311
Select 7.5 Pitch	ESC [ 7 w	311



---

Select 6.0 Pitch	ESC [ 6 w	311
Select 5.0 Pitch	ESC [ 5 w	311
Select Font Pitches	ESC [ ? 2 9 h	311
Select All Pitches	ESC [ ? 2 9 l	312

---

*Print Style*

Draft Quality Printing	ESC [ Ø " z or	312
	ESC [ 1 " z	312
Near Letter Quality Printing	ESC [ 2 " z	312
Enable Underline	ESC [ 4 m	313
Disable Underline	ESC [ 2 4 m	313
Enable Underline	ESC [ 2 m	313
Disable Underline	ESC [ Ø m	313

---

*Special Printhead Movement*

Set Active Column to Column n	ESC [ (n) `	314
Backspace	BS	314
Advance n Columns	ESC [ (n) a	314

---

*Print Direction*

Unidirectional Printing	ESC [ ? 4 1 h	315
Bidirectional Printing	ESC [ ? 4 1 l	315

*Tabs*

Set Horizontal Tab	ESC H or	316
at Current Column	ESC 1	316
Clear Horizontal Tab	ESC [ g or	316
at Current Column	ESC [ Ø g	316
Set Horizontal Tab at Column n	ESC [ (n) u	317
Set Multiple Horizontal Tabs	ESC [ (n1) ; (n2) ; ... (n16) u	317
Clear All Horizontal Tabs	ESC 2 or	317
	ESC [ 2 g or	317
	ESC [ 3 g	317
Horizontal Tab Set	HTS	318
Horizontal Tab	HT	318
Vertical Tab Set	VTs	318
Set Vertical Tab at	ESC J or	319
Current Line	ESC 3	319
Clear Vertical Tab at	ESC [ 1 g	319
Current Line		
Set Vertical Tab at Line n	ESC [ (n) v	319
Set Multiple Vertical Tabs	ESC [ (n1) ; (n2) ; ... (n15) v	320
Clear All Vertical Tabs	ESC 4 or	320
	ESC [ 4 g	320
Vertical Tab	VT	320

## ALPHABETICAL SUMMARY

Command	Function	Page	Command	Function	Page
BEL	Bell	299	ESC H	Set Horizontal Tab at Current Column	316
BS	Backspace	314	ESC J	Set Vertical Tab at Current Line	319
CAN	Cancel	299	ESC K	Advance Paper 1/12 Inch	309
CR	Carriage Return	296	ESC N (n)	Print Next Character from G2	286
CSI	Control Sequence Introducer	302	ESC O (n)	Print Next Character from G3	289
DCS 1 v	Device Control String (h1)...(h30)	302	ESC P 1 v	Define Answer Back (h1)...(h30) Message	301
ENQ	Return Answer Back Message	301	ESC P (n) q (d1)...(dx)	Graphics	303
ESC SP 6	Disable C1 Control Codes	299	ESC [ Ø " z	Draft Quality Printing	312
ESC SP 7	Enable C1 Control Codes	299	ESC [ Ø ; (n) s	Right Margin	291
ESC ( (n)	Select G0	284	ESC [ Ø g	Clear Horizontal Tab at Current Column	316
ESC ) (n)	Select G1	285	ESC [ Ø m	Disable Underline	313
ESC * (n)	Select G2	285	ESC [ Ø t	No Form Mode	298
ESC + (n)	Select G3	285	ESC [ Ø w	Select 10 Pitch	311
ESC 1	Set Horizontal Tab at Current Column	316	ESC [ Ø z	Set 6 Lines Per Inch	311
ESC 2	Clear All Horizontal Tabs	317	ESC [ 1 " z	Draft Quality Printing	312
ESC 3	Set Vertical Tab at Current Line	319	ESC [ 1 8 w	Select 18.2 Pitch	311
ESC 4	Clear All Vertical Tabs	320	ESC [ 1 g	Clear Vertical Tab at Current Line	319
ESC D	Index	308	ESC [ 1 w	Select 10 Pitch	311
ESC E	Linefeed with Carriage Return	308	ESC [ 1 z	Set 6 Lines Per Inch	290
ESC [ 2 g	Clear All Horizontal Tabs	317	ESC [ 2 " z	Near Letter Quality	312
ESC [ 2 m	Enable Underline	313	ESC [ ; (n) r	Bottom Margin	294
ESC [ 2 w	Select 12.0 Pitch	311	ESC [ (n1) ; (n2) r	Top and Bottom Margin	292
ESC [ 2 z	Set 8 Lines Per Inch	280	ESC [ ; (n) s	Right Margin	291
ESC [ 2 Ø h	Enable Linefeed/ Newline	296	ESC [ (n1) ; (n2) s	Left and Right Margin	292
ESC [ 2 Ø	Disable Linefeed/ Newline	296	ESC [ (n1) ; (n2) ; ... (n16) u	Set Multiple Horizontal Tabs	317
ESC [ 2 4 m	Disable Underline	313	ESC [ (n1) ; (n2) ; ... (n15) v	Set Multiple Vertical Tabs	320
			ESC [ ? 2 9 h	Select Font Pitches	311
			ESC [ ? 2 9	Select All Pitches	312
			ESC [ ? 4 Ø h	Enable Carriage Return/Newline	297

Command	Function	Page	Command	Function	Page
ESC [ 3 g	Clear All Horizontal Tabs	317	ESC [ ? 4 Ø	Disable Carriage Return/Newline	297
ESC [ 3 w	Select 15.0 Pitch	311	ESC [ ? 4 1 h	Unidirectional Printing	315
ESC [ 3 z	Set 12 Lines Per Inch	270	ESC [ ? 4 1	Bidirectional Printing	315
ESC [ 4 g	Clear All Vertical Tabs	320	ESC [ ? 7 h	Enable Auto Wraparound	297
ESC [ 4 m	Enable Underline	313	ESC [ ? 7	Disable Auto Wraparound	297
ESC [ 4 w	Select 16.67 Pitch	311	ESC [ (n) `	Set Active Column to Column n	314
ESC [ 4 z	Set 2 Lines Per Inch	270	ESC [ (n) a	Advance n Columns	314
ESC [ 5 w	Select 5.0 Pitch	311	ESC [ (n) d	Advance to Line n	310
ESC [ 5 z	Set 3 Lines Per Inch	270	ESC [ (n) e	Advance n Lines	310
ESC [ 6 w	Select 6.0 Pitch	311	ESC [ g	Clear Horizontal Tab at Current Column	316
ESC [ 6 z	Set 4 Lines Per Inch	270	ESC [ (n) r	Top Margin	293
ESC [ 7 w	Select 7.5 Pitch	311	ESC [ (n) s	Left Margin	291
ESC [ 8 w	Select 8.33 Pitch	311	ESC [ (n) t	Form Length	297
ESC [ 9 w	Select 9.1 Pitch	311	HT	Horizontal Tab	318
ESC [ (n1) ; (n2) " s	Set Print Area	295	IND	Index	308
ESC [ (n) ; Ø s	Left Margin	291	LF	Linefeed	309
ESC [ (n) u	Set Horizontal Tab at Current Column n	317	NEL	Next Line	308
ESC [ (n) v	Set Vertical Tab at Line n	319	HTS	Horizontal Tab Set	318
ESC [ w	Select 10.0 Pitch	311	VTs	Vertical Tab Set	318
ESC [ (n) w	Select Pitch	311	PLD	Partial Line Down	309
ESC [ z	Set 6 Lines Per Inch	270	SI	Map G0 into Lower Data Bytes	286
ESC [ (n) z	Select Line Spacing	270	SO	Map G1 into Lower Data Bytes	286
ESC \	String Terminator	302	SS2 (n)	Print Next Character from G2	288
ESC n	Map G2 into Lower Data Bytes	286	SS3 (n)	Print Next Character from G3	289
ESC o	Map G3 into Lower Data Bytes	287	ST	String Terminator	302
ESC	Map G3 into Upper Data Bytes	288	VT	Vertical Tab	320
ESC }	Map G2 into Upper Data Bytes	287			
ESC ~	Map G1 into Upper Data Bytes	287			
FF	Form Feed	310			

## 4100 PRINTER VS DEC LA210 PRINTER

A few difference exist between the DEC LA210 emulation in the 4100 printer and the DEC LA210 printer, as described in the following subsections.

### UNSUPPORTED DEC COMMANDS

The following DEC LA210 commands are not available in this DEC LA210 emulation:

ESC SP G	Enable 8-bit Transmission
ESC SP F	Disable 8-bit Transmission
ESC [ (n) A	Initiate n Reverse Linefeeds
ESC m	Reverse Linefeed
ESC ,	Select Alternate Character Sets (see Note)
ESC -	Select Alternate Character Sets (see Note)
ESC .	Select Alternate Character Sets (see Note)
ESC /	Select Alternate Character Sets (see Note)
ESC [ ? 1 Ø c	Font Configuration Report
ESC Z	Printer ID
ESC _	Application Program Command
ESC ]	Operating System Command
ESC ^	Privacy Message
RI	Reverse Index
ESC L	Partial Line Up
PLU	Partial Line Up
OSC	Operating System Command
PM	Privacy Message
APC	Application Program Command
ESC [ 1 Ø m through ESC [ 1 4 m	Specify Character Fonts

*Note:* All character sets can be selected with other commands.

In addition to the DEC LA210 functions listed on the previous page, commands that are supported by the DEC LA210—yet perform no function on the DEC LA210 printer—and are not supported in DEC LA210 emulation on the 4100 printer, are listed below:

EOT	End of Transmission	ESC A	Reserved
DLE	Data Link Escape	ESC B	Reserved
DC2	Device Control 2	ESC F or SSA	Start of Selected Area
DC4	Device Control 4		
NAK	Negative Acknowledge	ESC G or ESA	End of Selected Area
SYN	Synchronous Idle	ESC I or HTJ	Horizontal Tab with Justification
ETB	End of Transmission Block	ESC Q or PU1	Private Use 1
EM	End of Medium	ESC R or PU2	Private Use 2
SUB	Substitute	ESC S or STS	Set Transmit State
FS	File Separator	ESC T or CCH	Cancel Character
GS	Group Separator	ESC U or MW	Message Waiting
RS	Record Separator	ESC V or SPA	Start of Protected Area
US	Unit Separator		
DEL	Delete	ESC W or EPA	End of Protected Area
ESC @	Reserved		
		ESC X	Reserved
		ESC Y	Reserved
		ESC Z	Reserved

## CHARACTER PITCH DIFFERENCES

Control commands used to set character pitch are the same in the DEC emulations of the 4100 printer and DEC LA210 printers, except for commands shown in the table below:

Control Sequence	Character Pitch	
	LA210 Printer	4100 Printer
ESC[3w	13.2 pitch	15.0 pitch
ESC[4w	16.5 pitch	16.67 pitch
ESC[7w	6.6 pitch	7.5 pitch
ESC[8w	8.25 pitch	8.33 pitch
ESC[9w	_____	9.1 pitch
ESC[18w	_____	18.2 pitch

## GRAPHICS DENSITY DIFFERENCES

Graphics densities available in the 4100 printer are different than graphics densities available in the DEC LA210 printer. The differences are shown in the following tables.

**DEC LA210 Printer Graphics Densities**

Dots/inch	Overlap	Aspect ratio	Dots/line	Inches/Line
330	77.00%	4.58	4350	13.18
220	66.00%	3.04	2880	13.09
168	55.00%	2.29	2160	13.09
132	50.00%	1.83	1760	13.18
110	32.00%	1.50	1440	13.09
94	20.00%	1.30	1250	13.05
83	9.00%	1.12	1080	13.09
74	0.00%	1.02	960	13.09

**DEC LA210 Emulation Graphics Densities**

(assuming any pitch except 12.0 or 6.0 pitch set prior to beginning graphics)

<b>Dots/inch</b>	<b>Overlap</b>	<b>Aspect ratio</b>	<b>Dots/line</b>	<b>Inches/line</b>
240	64.29%	3.36	3168	13.2
240	64.29%	3.36	3168	13.2
150	52.38%	2.08	1980	13.2
120	40.48%	1.67	1584	13.2
100	28.57%	1.39	1320	13.2
100	28.57%	1.39	1320	13.2
75	04.76%	1.04	990	13.2
75	04.76%	1.04	990	13.2

**DEC LA210 Emulation Printer Graphics Densities**

(assuming 12.0 or 6.0 pitch set prior to beginning graphics)

<b>Dots/inch</b>	<b>Overlap</b>	<b>Aspect ratio</b>	<b>Dots/Line</b>	<b>Inches/Line</b>
240	64.29%	3.36	3168	13.2
240	64.29%	3.36	3168	13.2
180	52.38%	2.08	2376	13.2
180	40.48%	1.67	2376	13.2
120	28.57%	1.39	1584	13.2
120	28.57%	1.39	1584	13.2
90	04.76%	1.04	1188	13.2
90	04.76%	1.04	1188	13.2



## CHARACTER MAPS

The control commands on the next several pages enable you to pre-select four different character maps, then map them into the lower or upper data bytes when you are ready to use them. These commands are valid only while the printer is in DEC LA210 emulation.

A DEC character map is an assignment of printable characters to some data bytes between 0 and 255. It contains printable characters only and does not contain control codes.

The lower data bytes are 33 through 126 decimal (21 through 7E hexadecimal). The upper data bytes are 161 through 254 decimal (A1 through FE hexadecimal). The positions of the lower and upper data bytes are shown in the illustration on the next page.

The four pre-selectable character maps are called G0, G1, G2, and G3. "G0" through "G3" are equivalent to the character maps that Digital Equipment Corporation refers to as "Graphics 0" through "Graphics 3". The lower and upper data bytes are equivalent to the character maps Digital Equipment Corporation refers to as "GL" (Graphics Left) and "GR" (Graphics Right).

Any character map available in DEC LA210 emulation may be selected as G0, G1, G2, or G3. These selections are stored in permanent memory and are not lost at power off. Default selections are shown below:

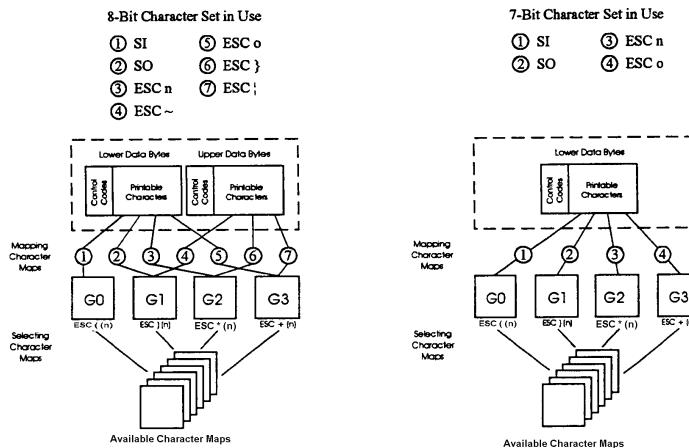
- G0: United States Character Map
- G1: VT100 Line Draw Character Map
- G2: Multilingual Character Map
- G3: United States Character Map

Techniques for mapping preselected character maps into lower or upper data bytes are shown in the following illustration. Default mappings are shown below:

- Lower Data Bytes: G0
- Upper Data Bytes: G2

All available character maps are primary character maps and the printer supports the DEC LA210 control commands used to select primary character maps. No alternate character maps are available and control codes to select alternate character maps are not supported.

The illustration that follows shows how character maps G0 through G3 are selected as national-use, multilingual, or VT100 line draw maps, and then how those maps are selected for the lower and upper data bytes of the character set.



## DEC LA210 Emulation Character Mapping

Character maps for DEC LA210 may be selected using the configuration menu or with control commands. Differences between these methods are described below.

### **Using the Configuration Menu to Select Character Maps**

Using the configuration menu, you can select character maps G0, G1, G2 and G3 for the 7-bit or 8-bit DEC character set. Different character maps may be selected.

Character map G0 can be mapped only into the lower data bytes. Character maps G1 through G3 can be mapped into either or both the lower and upper data bytes.

The character maps selected for G0 and G2 become active when you turn on the printer. The character maps selected for G1 and G3 may be invoked using the commands shown in this section.

### **Using Control Commands to Select Character Maps**

Using the control commands shown on the following pages, you can assign any character map to G0 through G3. The assignments are active when mapped into the lower or upper data bytes using the mapping commands shown in this section.

Character map G0 can be mapped only into the lower data bytes. G1, G2, and G3 may be mapped into either or both the lower and upper data bytes. Before you can access map G1 through G3 in the upper data bytes, the "8 Bit DEC" option must be selected from the configuration menu; otherwise, the command is stored in memory until the upper data bytes have been enabled.

The control commands to select character maps G0 through G3 are:

- ESC ( (n)    Select G0    ESC ) (n)    Select G1
- ESC \* (n)    Select G2    ESC + (n)    Select G3

n specifies the character map as follows:

n=Character Map		n=Character Map		n=Character Map	
A	United Kingdom	Z	Spain	5	Finland
B	United States	h	Hebrew	6	Norway/Denmark
K	Germany	<	Multilingual	7	Sweden
R	France	0	VT100 Line Draw	9	Canada
Y	Italy				

With the exception of Multilingual and VT100 Line Draw, the available character maps are national-use character maps. See Appendix D for charts of these character maps.

Additional information for each command is provided on the following pages.

ESC ( (n)				Select G0
<i>ASCII:</i>	ESC	(	(n)	
<i>Control:</i>	CTRL [	(	(n)	
<i>Decimal:</i>	27	40	(n)	
<i>Hexadecimal:</i>	1B	28	(n)	

Assigns a character map to G0. n specifies one of the character maps listed previously.

This control command does not change the character set currently in use. The selection takes effect when G0 is mapped into the lower data bytes using control code SI. G0 cannot be mapped into the upper data bytes.

ESC ) (n)				Select G1
<i>ASCII:</i>	ESC	)	(n)	
<i>Control:</i>	CTRL [	)	(n)	
<i>Decimal:</i>	27	41	(n)	
<i>Hexadecimal:</i>	1B	29	(n)	

Assigns a character map to G1. n specifies one of the character maps listed previously.

This control command does not change the character set currently in use. The selection takes effect when G1 is mapped into the lower or upper data bytes using control command SO or ESC ~, respectively.

ESC * (n)				Select G2
<i>ASCII:</i>	ESC	*	(n)	
<i>Control:</i>	CTRL [	*	(n)	
<i>Decimal:</i>	27	42	(n)	
<i>Hexadecimal:</i>	1B	2A	(n)	

Assigns a character map to G2. n specifies one of the character maps listed previously.

This control command does not change the character set currently in use. The selection takes effect when G2 is mapped into the lower or upper data bytes using control command ESC n or ESC }, respectively.

ESC + (n)				Select G3
<i>ASCII:</i>	ESC	+	(n)	
<i>Control:</i>	CTRL [	+	(n)	
<i>Decimal:</i>	27	43	(n)	
<i>Hexadecimal:</i>	1B	2B	(n)	

Assigns a character map to G3. n specifies one of the character maps listed previously.

This control command does not change the character set currently in use. The selection takes effect when G3 is mapped into the lower or upper data bytes using control command ESC o or ESC !, respectively.

The following example selects the U.K. character map for G3 and then maps G3 into the upper data bytes.

*Example*

```
LPRINT CHR$(27);"+A";  
LPRINT CHR$(27);"!";
```

SI	Map G0 into Lower Data Bytes (default)
ASCII:	SI
Control:	CTRL 0
Decimal:	15
Hexadecimal:	0F

Maps the G0 character map selected with control command ESC ( into the lower data bytes, making that character map active for printing.

SO	Map G1 into Lower Data Bytes
ASCII:	SO
Control:	CTRL N
Decimal:	14
Hexadecimal:	0E

Maps the G1 character map selected with control command ESC ) into the lower data bytes, making that character map active for printing.

ESC n	Map G2 into Lower Data Bytes
ASCII:	ESC n
Control:	CTRL [
Decimal:	27      110
Hexadecimal:	1B      6E

Maps the G2 character map selected with control command ESC \* into the lower data bytes, making that character map active for printing.

To print only one character from the character map designated as G2, use control command ESC N.

ESC o	Map G3 into Lower Data Bytes	
<i>ASCII:</i>	ESC	o
<i>Control:</i>	CTRL [	o
<i>Decimal:</i>	111	
<i>Hexadecimal:</i>	6F	

Maps the G3 character map selected with control command ESC + into the lower data bytes, making that character map active for printing.

To print only one character from the character map selected as G3, use ESC O.

ESC ~	Map G1 into Upper Data Bytes*	
<i>ASCII:</i>	ESC	~
<i>Control:</i>	CTRL [	~
<i>Decimal:</i>	27	126
<i>Hexadecimal:</i>	1B	7E

Maps the G1 character map selected with control command ESC ) into the upper data bytes, making that character map active for printing.

ESC }	Map G2 into Upper Data Bytes (default)*	
<i>ASCII:</i>	ESC	}
<i>Control:</i>	CTRL [	}
<i>Decimal:</i>	27	125
<i>Hexadecimal:</i>	1B	7D

Maps the G2 character map selected with control command ESC \* into the upper data bytes, making that character map active for printing.

To print only one character from the character map selected as G2, use ESC N.

ESC	Map G3 into Upper Data Bytes*
ASCII: ESC	
Control: CTRL [	
Decimal: 27 124	
Hexadecimal: 1B 7C	

Maps the G3 character map selected with control command ESC + into the upper data bytes, making that character map active for printing. (See ESC + (n) for an example.)

To print only one character from the character map selected as G3, use ESC O.<sup>1</sup>

ESC N or SS2	Print Next Character from G2
ASCII: ESC N (n)	
Control: CTRL [ N (n)	
Decimal: 27 78 (n)	
Hexadecimal: 1B 4E (n)	
ASCII: SS2 (n)	
Control: not applicable	
Decimal: 142 (n)	
Hexadecimal: 8E (n)	

Prints the next character from the G2 character map selected with control command ESC \*. n specifies the character to print. The value of n must be from 0 to 127. G2 does not need to be currently active (that is, mapped into the lower or upper data bytes) to use this command.

Both commands perform the same function. SS2 is valid only if "8 Bit DEC" has been set in the configuration menu and if the C1 control codes have been enabled using ESC SP 7.

This command is valid for printing one character only. To print continuously from the G2 character map, use control sequence ESC n or

---

<sup>1</sup> To print the upper data byte characters, the "8 Bit DEC" option must be set in the configuration menu. If the "7 Bit DEC" option is set, these commands are stored in memory but not invoked until "8 Bit DEC" is selected.



ESC } to map G2 into the lower or upper data bytes, respectively, making that character map active for printing.

ESC O or SS3		Print Next Character from G3	
<i>ASCII:</i>	ESC O	(n)	
<i>Control:</i>	CTRL [ O	(n)	
<i>Decimal:</i>	27 79	(n)	
<i>Hexadecimal:</i>	1B 4F	(n)	
<i>ASCII:</i>	SS3	(n)	
<i>Control:</i>	not applicable		
<i>Decimal:</i>	143	(n)	
<i>Hexadecimal:</i>	8F	(n)	

Prints the next character from the G3 character map selected with control sequence ESC +. n specifies the character to print. The value of n must be from 0 to 127. G3 does not need to be currently active (that is, mapped into the lower or upper data bytes) to use this command.

Both commands perform the same function. SS3 is valid only if "8 Bit DEC" has been set in the configuration menu and if the C1 control codes have been enabled using ESC SP 7.

This command is valid for printing one character only. To print continuously from the G3 character map, use control code ESC o or ESC | to map G3 into the lower or upper data bytes, respectively, making that character map active for printing.

The following prints the character £ from the U.K. character set.

### *Example*

```
LPRINT CHR$(27);"+A";
LPRINT CHR$(27);"O";
LPRINT "#";
```

# **LINES PER INCH**

ESC [ (n) z				Set Line Spacing
<i>ASCII:</i>	ESC	[	(n)	z
<i>Control:</i>	CTRL [	[	(n)	z
<i>Decimal:</i>	27	91	(n)	122
<i>Hexadecimal:</i>	1B	5B	(n)	7A

Sets the number of lines to be printed on each vertical inch (also called vertical pitch). n specifies the line spacing as follows:

**Lines Per Inch:    2       3       4       6       6       8       12**

Value of n

<i>ASCII</i>	4	5	6	0	1	2	3
<i>Decimal</i>	52	53	54	48	49	50	51
<i>Hexadecimal</i>	34	35	36	30	31	32	33

6 lines per in. line spacing may also be set using ESC [ z, without sending parameter n.

When the lines per inch setting is changed, the active line moves down after the next vertical paper motion command to the next even multiple of the new vertical pitch. The physical positions of the vertical tabs are also altered. Changing lines per inch does not reset the top or bottom margin.

## MARGINS

ESC [ (n) s or ESC [ (n) ; Ø s						Left Margin <sup>2</sup>
<i>ASCII:</i>	ESC	[	(n)	s		
<i>Control:</i>	CTRL [	[	(n)	s		
<i>Decimal:</i>	27	91	(n)	115		
<i>Hexadecimal:</i>	1B	5B	(n)	73		
<i>ASCII:</i>	ESC	[	(n)	;	Ø	s
<i>Control:</i>	CTRL [	[	(n)	;	Ø	s
<i>Decimal:</i>	27	91	(n)	59	48	115
<i>Hexadecimal:</i>	1B	5B	(n)	3B	30	73

Sets the left margin to Column n. The left margin is the first column in which characters are printed. The valid range for n is from 1 to one column less than the right margin setting.

Both control commands perform the same function.

ESC [ ; (n) s or ESC [ Ø ; (n) s						Right Margin <sup>2</sup>
<i>ASCII:</i>	ESC	[	;	(n)	s	
<i>Control:</i>	CTRL [	[	;	(n)	s	
<i>Decimal:</i>	27	91	59	(n)	115	
<i>Hexadecimal:</i>	1B	5B	3B	(n)	73	
<i>ASCII:</i>	ESC	[	Ø	;	(n)	s
<i>Control:</i>	CTRL [	[	Ø	;	(n)	s
<i>Decimal:</i>	27	91	48	59	(n)	115
<i>Hexadecimal:</i>	1B	5B	30	3B	(n)	73

Sets the right margin to Column n.

<sup>2</sup> Selecting or cancelling font pitches, changing the print quality to draft or NLQ, or changing the print area modifies horizontal margin settings.

If the active column is greater than the new right margin, the next printable character activates the autowrap feature.

The value of  $n$  for the right margin depends on the setting of the left margin and the selected pitch (where LM is the setting for the left margin):

- 5.0 pitch:  $LM + 1 \leq n \leq 66$
- 6.0 pitch:  $LM + 1 \leq n \leq 79$
- 7.5 pitch:  $LM + 1 \leq n \leq 99$
- 8.33 pitch:  $LM + 1 \leq n \leq 109$
- 9.1 pitch:  $LM + 1 \leq n \leq 120$

If  $n$  is greater than the upper limit, the maximum permitted value is assumed.

ESC [ (n1) ; (n2) s						Left and Right Margin
ASCII:	ESC	[	(n1)	;	(n2)	s
Control:	CTRL [	[	(n1)	;	(n2)	s
Decimal:	27	91	(n1)	59	(n2)	115
Hexadecimal:	1B	5B	(n1)	3B	(n2)	73

Sets the left margin to Column  $n1$  and the right margin to Column  $n2$ .

The value of  $n2$  for the right margin depends on the setting of the left margin and the selected pitch:

- 5.0 pitch:  $n1 + 1 \leq n2 \leq 66$
- 6.0 pitch:  $n1 + 1 \leq n2 \leq 79$
- 7.5 pitch:  $n1 + 1 \leq n2 \leq 99$
- 8.33 pitch:  $n1 + 1 \leq n2 \leq 109$
- 9.1 pitch:  $n1 + 1 \leq n2 \leq 120$
- 10.0 pitch:  $n1 + 1 \leq n2 \leq 132$
- 12.0 pitch:  $n1 + 1 \leq n2 \leq 158$
- 15.0 pitch:  $n1 + 1 \leq n2 \leq 198$

- 16.67 pitch:  $n1 + 1 \leq n2 \leq 219$
- 18.2 pitch:  $n1 + 1 \leq n2 \leq 240$

If  $n2$  is greater than the upper limit, the maximum permitted value is assumed.

*Note:* Selecting or cancelling font pitches, changing the print quality to draft or NLQ, or changing the print area modifies horizontal margin settings. If  $n1$  or  $n2$  sets the margins past the print area defined with control command ESC [  $n1$  ;  $n2$  " s, the sequence is ignored.

If the active column is greater than the new right margin, the next printable character activates the Auto Wraparound feature.

The following example sets the right and left margins at approximately 1.25 in., assuming an 8½ in. wide paper at 10 character columns per in.

### Example

```
LPRINT CHR$(27);"13;67s";
```

ESC [ (n) r					Top Margin
<i>ASCII:</i>	ESC	[	(n)	r	
<i>Control:</i>	CTRL [	[	(n)	r	
<i>Decimal:</i>	27	91	(n)	114	
<i>Hexadecimal:</i>	1B	5B	(n)	72	

Sets the top margin to Line  $n$ . The maximum value of  $n$  is the form length set with control sequence ESC [ (n) t.

The top margin is reset to Line 1 if the form length is changed. Changing the lines per inch does not affect the top margin setting.

ESC [ ; (n) r						Bottom Margin
<i>ASCII:</i>	ESC	[		;	(n)	r
<i>Control:</i>	CTRL [	[		;	(n)	r
<i>Decimal:</i>	27	91		59	(n)	114
<i>Hexadecimal:</i>	1B	5B		3B	(n)	72

Sets the bottom margin to Line n. The maximum value of n is one line less than the form length set with control sequence ESC [ (n) t.

The bottom margin is reset to its maximum value (determined by form length) if the form length setting is changed. Changing the lines per inch does not affect the bottom margin setting.

ESC [ (n1) ; (n2) r							Top and Bottom Margin
<i>ASCII:</i>	ESC	[		(n1)	;	(n2)	r
<i>Control:</i>	CTRL [	[		(n1)	;	(n2)	r
<i>Decimal:</i>	27	91		(n1)	59	(n2)	114
<i>Hexadecimal:</i>	1B	5B		(n1)	3B	(n2)	72

Sets the top margin to Line n1 and the bottom margin to Line n2.

The top margin is reset to Line 1 and the bottom margin to its maximum value (determined by form length) if the form length is changed. Changing the lines per inch does not affect the top or bottom margin settings.

The following sets the top and bottom margins at 1 in., assuming an 11 in. form at 6 lines per in.

### *Example*

```
LPRINT CHR$(27);"[6;60r";
```

ESC [ (n1) ; (n2) " s							Set Print Area
<i>ASCII:</i>	ESC	[	(n1)	;	(n2)	"	s
<i>Control:</i>	CTRL [	[	(n1)	;	(n2)	"	s
<i>Decimal:</i>	27	91	(n1)	59	(n2)	34	115
<i>Hexadecimal:</i>	1B	5B	(n1)	3B	(n2)	22	73

Sets the print area to the position specified by n1 and n2.

The left edge of the print area is the position n1/12 in. from the physical left edge of the paper. The right edge of the print area is the position n2/12 in. to the right of the left edge.

The left margin is placed one character width to the right of the left edge of the print area. The right margin is placed one character width to the left of the right edge of the print area.

When the print area is defined, all existing tab positions are defined relative to the left edge of the print area. Tabs retain their column reference numbers.

For example, if no print area has been defined and tabs are set at Columns 8, 16, and 24, and then, if n1 is set to 12 and n2 is set to 96, the results are as follows:

- The left edge of the print area is 1 in. right of the physical left edge of the paper. The right edge of the print area is 8 in. right of the left edge of the print area; a total of 9 in. from the physical left edge of the paper.
- The left margin is set 1 in. plus one character width right of the physical left edge of the paper.
- The right margin is set 8 in. minus one character width right of the left edge of the print area.
- Tabs are 1 in. right of their previous position, but remain numbered 8, 16, and 24.

If n1 or n2 is set to zero, the previously defined print area remains in effect.

If the new right margin is left of the current column and Auto Wraparound is enabled, the next character is printed on a new line.

## MISCELLANEOUS

ESC [ 2 Ø h						Enable Linefeed/Newline
ASCII:	ESC	[	2	Ø	h	
Control:	CTRL [	[	2	Ø	h	
Decimal:	27	91	50	48	104	
Hexadecimal:	1B	5B	32	30	68	

Returns the active column to the left margin when LF or VT is performed.

ESC [ 2 Ø I						Disable Linefeed/Newline
ASCII:	ESC	[	2	Ø	I	
Control:	CTRL [	[	2	Ø	I	
Decimal:	27	91	50	48	108	
Hexadecimal:	1B	5B	32	30	6C	

Does not change the active column when LF or VT is performed.

CR		Carriage Return
ASCII:	CR	
Control:	CTRL M	
Decimal:	13	
Hexadecimal:	0D	

Prints all data stored in the print buffer and sets the active column to the left margin. If Auto Linefeed (LF on CR) is enabled, a linefeed is performed.

If Carriage Return/Newline is enabled, a linefeed is performed after the carriage return.



ESC [ ? 4 Ø h							Enable Carriage Return/Newline
ASCII:	ESC	[	?	4	Ø	h	
Control:	CTRL [	[	?	4	Ø	h	
Decimal:	27	91	63	52	48	104	
Hexadecimal:	1B	5B	3F	34	30	68	

When a carriage return is performed, the active column returns to the left margin and the paper advances one line.

ESC [ ? 4 Ø I							Disable Carriage Return/Newline
ASCII:	ESC	[	?	4	Ø	I	
Control:	CTRL [	[	?	4	Ø	I	
Decimal:	27	91	63	52	48	108	
Hexadecimal:	1B	5B	3F	34	30	6C	

When a carriage return is performed, the active column returns to the left margin and the paper does not advance.

ESC [ ? 7 h							Enable Auto Wraparound
ASCII:	ESC	[	?	7	h		
Control:	CTRL [	[	?	7	h		
Decimal:	27	91	63	55	104		
Hexadecimal:	1B	5B	3F	37	68		

Turns on Auto Wraparound mode. Any characters received that would place the active column past the right margin are printed on the next line, starting at the left margin. Auto Wraparound mode remains in effect until control command ESC [ ? 7 I is received.

ESC [ ? 7 •							Disable Auto Wraparound
ASCII:	ESC	[	?	7	•		
Control:	CTRL [	[	?	7	•		
Decimal:	27	91	63	55	108		
Hexadecimal:	1B	5B	3F	37	6C		

Turns off Auto Wraparound mode set with control sequence ESC [ ? 7 h. any characters received that would place the active column past the right margin are not printed. The printhead remains at the right margin position until a line terminator is received.

ESC [ (n) t	Form Length
-------------	-------------

<i>ASCII:</i>	ESC	[	(n)	t
<i>Control:</i>	CTRL [	[	(n)	t
<i>Decimal:</i>	27	91	(n)	116
<i>Hexadecimal:</i>	1B	5B	(n)	74

Sets the length of the form to n lines, not physical units. Changing the vertical pitch (lines per in.) alters the physical form length.

The maximum value of n is determined by the current vertical lines per inch setting, as follows:

- 6 lines per in.: n = 132, max.
- 8 lines per in.: n = 176, max.

Changing form length clears the vertical margins and defines the current line as Line 1.

If the value of n is 0, the printer enters No Form mode. Refer to the following command.

ESC [ Ø t				No Form Mode
<i>ASCII:</i>	ESC	[	Ø	t
<i>Control:</i>	CTRL [	[	Ø	t
<i>Decimal:</i>	27	91	48	116
<i>Hexadecimal:</i>	1B	5B	30	74

Causes the printer to enter No Form mode. In this mode, there are no vertical margins or form length. Printing is continuous and line spacing is determined by the current pitch.

This command overrides the form length setting selected from the configuration menu. No Form mode remains in effect until the printer power is turned off, or a new, nonzero form length is set with ESC [ (n) t.

BEL	Bell
ASCII: BEL Control: CTRL G Decimal: 7 Hexadecimal: 07	

Sounds the beeper for approximately 0.1 second.

The printer accepts up to ten sequential BEL commands; additional BEL commands are ignored.

CAN	Cancel
ASCII: CAN Control: CTRL X Decimal: 24 Hexadecimal: 18	

Cancels any control function before it is finished. When received in graphics mode, CAN returns the printer to text mode.

ESC SP 7	Enable C1 Control Codes
ASCII: ESC SP 7 Control: CTRL [ SP 7 Decimal: 27 32 55 Hexadecimal: 1B 20 37	

Enables the printer to receive and interpret the C1 control codes, decimal range 128 to 159, if upper data bytes have been enabled by selecting "8 Bit DEC" in the configuration menu. See the following command.

ESC SP 6	Disable C1 Control Codes
ASCII: ESC SP 6 Control: CTRL [ SP 6 Decimal: 27 32 54 Hexadecimal: 1B 20 36	

Causes the MSB in C1 control codes, decimal range 128 to 159, to be set to 0, effectively mapping control functions to them to C0, decimal range 000 to 031.

Two groups of control codes may be active in the printer: C0 (decimal range 000 to 031) and C1 (decimal range 128 to 159).

Control codes in C0 are always active. Control codes in C1 are enabled if upper data bytes have been enabled by selecting "8 Bit DEC" in the configuration menu and if control command ESC SP 7 has been received. Otherwise, the printer sets the MSB of data bytes received in the decimal range 128 to 159 to 0, effectively mapping them to C0, decimal range 000 to 031.

The position of the control codes is shown in these maps.

**C0 Control Codes**

HEX	0-	1-
-0	NUL	
-1	SOH	DC1
-2		
-3		DC3
-4		
-5	ENQ	
-6		
-7	BEL	
-8	BS	CAN
-9	HT	
-A	LF	
-B	VT	ESC
-C	FF	
-D	CR	
-E	SO	
-F	SI	

**C1 Control Codes**

HEX	8-	9-
-0	NUL	DCS
-1		
-2		
-3		
-4	IND	
-5	NEL	
-6		
-7		
-8	HTS	
-9		
-A	VTs	
-B	PLD	CSI
-C		ST
-D		
-E	SS2	
-F	SS3	

ESC P 1 v					Define Answer Back Message
ASCII:	ESC	P	1	v	(h1)...(h30)
Control:	CTRL [	P	1	v	(h1)...(h30)
Decimal:	27	80	49	118	(h1)...(h30)
Hexadecimal:	1B	50	31	76	(h1)...(h30)

Enters an Answer Back Message string in permanent memory. When control code ENQ is received, the printer sends this Answer Back Message back to the host.

h1 through h30 are hexadecimal numbers representing characters of the Answer Back Message.

The message may contain up to 30 characters, including spaces. Additional characters are discarded. If the message is less than 30 characters long, use control sequence ESC \ (or control code ST if the upper control codes are enabled) to terminate the message.

Both printable characters and control characters can be used in the message. The message remains in permanent memory until a new message is defined.

The following example defines the message "LA210."

### **Example**

```
LPRINT CHR$(27);"P1v4C41323130";
LPRINT CHR$(27);"\";
```

ENQ					Return Answer Back Message
ASCII:	ENQ				
Control:	CTRL E				
Decimal:	5				
Hexadecimal:	05				

Returns the message defined with the Define Answer Back Message command ESC P 1 v (h1)...(hx). The message is sent back to the host on the serial port.

DCS 1 v				Device Control String
<i>ASCII:</i>	DCS	1	v	(h1)...(h30)
<i>Control:</i>	not applicable			
<i>Decimal:</i>	144	49	118	(h1)...(h30)
<i>Hexadecimal:</i>	90	31	76	(h1)...(h30)

Performs the same function as ESC P 1 v, that is, it introduces a graphics string or enters an Answer Back message string. DCS is valid only if the upper data bytes have been enabled by selecting "8 Bit DEC" in the configuration menu and if the C1 control codes have been enabled using ESC SP 7.

ESC \ or ST			String Terminator
ASCII:	ESC	\	
Control:	CTRL [	\	
Decimal:	27	92	
Hexadecimal:	1B	5C	
ASCII:	ST		
Control:	not applicable		
Decimal:	156		
Hexadecimal:	9C		

Exits graphics mode and returns to text processing mode. Also terminates a Define Answer Back Message or Device Control String. Both commands perform the same function. ST is valid only if the upper data bytes have been enabled by selecting "8 Bit DEC" in the configuration menu and if the C1 control codes have been enabled using ESC SP 7.

CSI		Control Sequence Introducer
<i>ASCII:</i>	CSI	
<i>Control:</i>	not applicable	
<i>Decimal:</i>	155	
<i>Hexadecimal:</i>	9B	

Performs the same function as ESC [. ESC [ is always valid. CSI is valid only if the upper data bytes have been enabled by selecting "8 Bit DEC" in the configuration menu and if the C1 control codes have been enabled using ESC SP 7.

For example, ESC [ z and CSI z are recognized by the printer as identical commands: each sets line spacing to 6 lines per in.

## GRAPHICS

ESC P (n) q (d1)..(dx)						Graphics
<i>ASCII:</i>	ESC	P	(n)	q	(d1)..(dx)	
<i>Control:</i>	CTRL [	P	(n)	q	(d1)..(dx)	
<i>Decimal:</i>	27	80	(n)	113	(d1)..(dx)	
<i>Hexadecimal:</i>	1B	50	(n)	71	(d1)..(dx)	

Causes the printer to print graphics dot columns.

n specifies the graphics density. This determines the horizontal dot-column spacing, the

horizontal dots per inch, the horizontal overlap, the aspect ratio, the dot columns per line, and the inches per line. The values for n are shown in the tables below.

### Graphics Densities

The table below assumes any pitch other than 12.0 or 6.0 set prior to beginning graphics.

(n)	Dots/ inch	Overlap	Aspect ratio	Dots/ line	Inches/ line
2	240	64.29%	3.36	3168	13.2
3	240	64.29%	3.36	3168	13.2
4	150	52.38%	2.08	1980	13.2
5, 0, or 1	120	40.48%	1.67	1584	13.2
6	100	28.57%	1.39	1320	13.2
7	100	28.57%	1.39	1320	13.2
8	75	04.76%	1.04	990	13.2
9	75	04.76%	1.04	990	13.2

The table below assumes 12.0 or 6.0 set prior to beginning graphics.

(n)	Dots/ inch	Overlap	Aspect ratio	Dots/ line	Inches/ line
2	240	64.29%	3.36	3168	13.2
3	240	64.29%	3.36	3168	13.2
4	180	52.38%	2.08	2376	13.2
5, 0, or 1	180	40.48%	1.67	2376	13.2
6	120	28.57%	1.39	1584	13.2
7	120	28.57%	1.39	1584	13.2
8	90	04.76%	1.04	1188	13.2
9	90	04.76%	1.04	1188	13.2

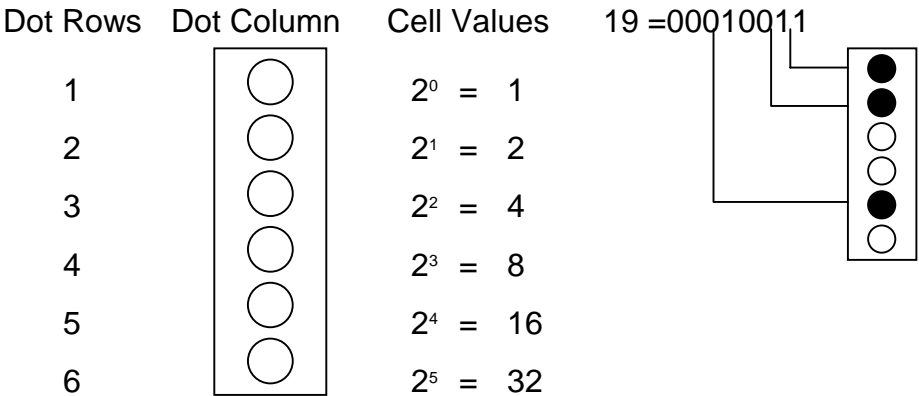
*Note:* Graphics densities available in the 4100 printer are different than graphics densities on the DEC LA210 printer. The differences are mentioned in "Graphics Density Differences" earlier in this section.

d1 through dx are data byte values from 63 decimal to 126 decimal (3F hexadecimal to 7E hexadecimal), each representing a graphics dot column. Subtract 63 decimal from each byte and convert the result to an 8-bit binary expression. The bits set to logic 1 in the binary expression correspond to the printhead pins that fire to create dots in each dot column. If a bit is set, the corresponding pin fires. If it is not set, the corresponding pin does not fire. In each line, 6 printhead pins may fire during graphics. The least significant bit in the binary expression corresponds to the top pin. See the following examples.



The dot pattern for data byte value 82 is shown below.

$(82 - 63 = 19 = 00010011)$



If a dot pattern below 63 decimal is sent, a null column (no dots) is printed. If a dot pattern above 126 decimal is sent, a vertical line (all dots) is printed.

The following codes can be used within graphics mode to perform functions:

- Performs a carriage return and linefeed.
- \$ Performs a carriage return without linefeed.
- ! (n) Initiates n repeats of the next dot column. n may be any number from 0 to 65535. The next dot column is repeated n times. When the count has run out, any following dot columns are printed.

Control codes sent while the printer is in graphics mode are processed or ignored as follows:

Processed without exiting graphics mode		Ignored	
NUL	EOT	BS	FF
ENQ	BEL	LF	HT
DEL	SI	CR	VT
SO			

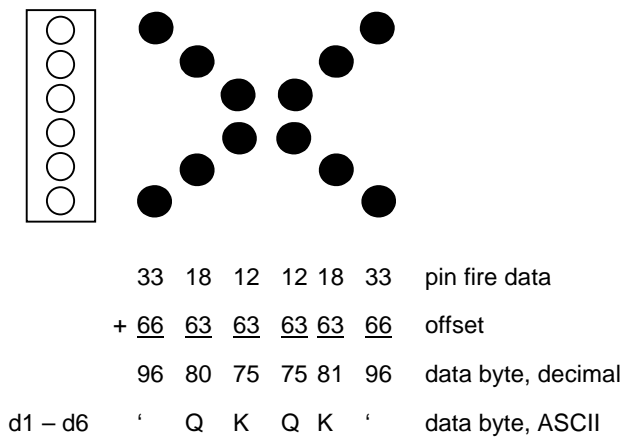
The printer remains in graphics mode until:

- The power is turned off.
- A valid C1 control code (decimal range 128 and 159) is received.
- A control command is received.
- A string terminator (ST or ESC \) is received.
- The control code CAN is received.

When one of these events occurs, all pending graphic data are printed out, the printer exits graphics mode, and the command is executed as normal.

**Example**

The following shows the command necessary to cause the printer to print an x-shaped graphics pattern:



```
REM PRINT X-SHAPED PATTERN USING  
REM 200 DOTS/INCH DENSITY GRAPHICS  
LPRINT CHR$(27);"P2q`QKKQ`";CHR$(27);"\";
```

## PAPER MOTION

ESC D or IND	Index
ASCII: ESC D	
Control: CTRL [ D	
Decimal: 27 68	
Hexadecimal: 1B 44	
ASCII: IND	
Control: not applicable	
Decimal: 132	
Hexadecimal: 84	

Advances the active line by one line. When the active line is advanced past the bottom margin, the active line is set to the top margin. IND does not change the active column.

Both commands perform the same function. IND is valid only if the upper data bytes have been enabled by selecting "8 Bit DEC" in the configuration menu and if the C1 control codes have been enabled using ESC SP 7.

ESC E or NEL	Linefeed with Carriage Return (Next Line)
ASCII: ESC E	
Control: CTRL [ E	
Decimal: 27 69	
Hexadecimal: 1B 45	
ASCII: NEL	
Control: not applicable	
Decimal: 133	
Hexadecimal: 85	

Advances the active line by one line and returns the active column to the left margin. Both commands perform the same function. NEL is valid only if the upper data bytes have been enabled by selecting "8 Bit DEC" in the configuration menu and if the C1 control codes have been enabled using ESC SP 7.

ESC K or PLD		Advance Paper 1/12 Inch
<i>ASCII:</i>	ESC	K
<i>Control:</i>	CTRL [	K
<i>Decimal:</i>	27	75
<i>Hexadecimal:</i>	1B	4B
<i>ASCII:</i>	PLD	
<i>Control:</i>	not applicable	
<i>Decimal:</i>	139	
<i>Hexadecimal:</i>	8B	

Performs a 1/12 in. paper feed. Linefeed/Newline mode does not affect this command. The active line is not modified. The next form feed is measured from the last active line, making

the next top of form reference inaccurate. Both commands perform the same function. Partial Line Down (PLD) is valid only if the upper data bytes have been enabled by selecting "8 Bit DEC" in the configuration menu and if the C1 control codes have been enabled using ESC SP 7.

LF		Linefeed
<i>ASCII:</i>	LF	
<i>Control:</i>	CTRL J	
<i>Decimal:</i>	10	
<i>Hexadecimal:</i>	0A	

Advances the active line by one line. When the active line is advanced past the bottom margin and above the top margin, the active line is set to the next top margin.

If Linefeed/Newline mode is enabled, LF also returns the active column to the left margin. LF does not change the active column.

ESC [ (n) d					Advance to Line n
ASCII:	ESC	[	(n)	d	
Control:	CTRL [	[	(n)	d	
Decimal:	27	91	(n)	100	
Hexadecimal:	1B	5B	(n)	64	

Advances the active line to Line n. When the active line is advanced past the bottom margin and above the next top margin, the active line is set to the next top margin.

ESC [ (n) e					Advance n Lines
ASCII:	ESC	[	(n)	e	
Control:	CTRL [	[	(n)	e	
Decimal:	27	91	(n)	101	
Hexadecimal:	1B	5B	(n)	65	

Advances the paper by n number of lines. If n is 0, 256 lines is assumed. When the active line is advanced past the bottom margin and above the next top margin, the active line is set to the next top margin.

FF					Form Feed
SCII:	FF				
Control:	CTRL L				
Decimal:	12				
Hexadecimal:	0C				

Advances the paper to the top margin of the next page. To advance the paper to the next top of form instead of the top margin, the top margin setting must be cleared. If Linefeed/Newline mode is enabled, the active column is returned to the left margin.

## PITCH

ESC [ (n) w					Select Pitch
<i>ASCII:</i>	ESC	[	(n)	w	
<i>Control:</i>	CTRL [	[	(n)	w	
<i>Decimal:</i>	27	91	(n)	119	
<i>Hexadecimal:</i>	1B	5B	(n)	77	

Sets the number of characters printed per horizontal inch. n specifies the pitch as follows:

Pitch:            5   6   7.5   8.33   9.1   10   10   12   15.0   16.67   18.2

Value of n

ASCII	5	6	7	8	9	0	1	2	3	4	1	8
Decimal	53	54	55	56	57	48	49	50	51	52	49	56
Hexadecimal	35	36	37	38	39	30	31	32	33	34	31	38

10 pitch may also be selected using ESC [ w, without sending parameter n.

Changing the pitch resets left and right margins to default settings.

ESC [ ? 2 9 h							Select Font Pitches
<i>ASCII:</i>	ESC	[	?	2	9	h	
<i>Control:</i>	CTRL [	[	?	2	9	h	
<i>Decimal:</i>	27	91	63	50	57	104	
<i>Hexadecimal:</i>	1B	5B	3F	32	39	68	

Sets pitch select mode to font pitches. In this mode, only certain character widths are printed. If currently printing in 10.0 to 18.2 pitch, only 10 characters per inch are printed. If printing in 5.0 to 9.1 pitch, only 5 characters per inch are printed.

ESC [ ? 2 9 I						Select All Pitches
<i>ASCII:</i>	ESC	[	?	2	9	I
<i>Control:</i>	CTRL [	[	?	2	9	I
<i>Decimal:</i>	27	91	63	50	57	108
<i>Hexadecimal:</i>	1B	5B	3F	32	39	6C

Cancels font pitches set with control sequence ESC [ ? 2 9 h. Sets pitch select mode to all pitches. The pitch in use prior to selecting font pitches is restored.

## PRINT STYLE

ESC [ Ø " z or ESC [ 1 " z						Draft Quality Printing
<i>ASCII:</i>	ESC	[	Ø	"	z	
<i>Control:</i>	CTRL [	[	Ø	"	z	
<i>Decimal:</i>	27	91	48	34	122	
<i>Hexadecimal:</i>	1B	5B	30	22	7A	
<i>ASCII:</i>	ESC	[	1	"	z	
<i>Control:</i>	CTRL [	[	1	"	z	
<i>Decimal:</i>	27	91	49	34	122	
<i>Hexadecimal:</i>	1B	5B	31	22	7A	

Selects draft quality printing. Cancels near letter quality printing selected from the configuration menu or with control command ESC [ 2 " z.

Both control commands perform the same function.

ESC [ 2 " z						Near Letter Quality Printing
<i>ASCII:</i>	ESC	[	2	"	z	
<i>Control:</i>	CTRL [	[	2	"	z	
<i>Decimal:</i>	27	91	50	34	122	
<i>Hexadecimal:</i>	1B	5B	32	22	7A	

Selects near letter quality printing. This print mode remains in effect until the printer is turned off or until reset with command ESC [ Ø " z or ESC [ 1 " z, or changed using the configuration menu or the NLQ control key.

Near letter quality printing is available only in 10, 12, and 15 pitch.



ESC [ 4 m					Enable Underline
<i>ASCII:</i>	ESC	[	4	m	
<i>Control:</i>	CTRL [	[	4	m	
<i>Decimal:</i>	27	91	52	109	
<i>Hexadecimal:</i>	1B	5B	34	6D	

Selects the underline function. All succeeding print characters are underlined until the function is disabled with control command ESC [ 2 4 m or ESC [ 0 m.

ESC [ 2 4 m						Disable Underline
<i>ASCII:</i>	ESC	[	2	4	m	
<i>Control:</i>	CTRL [	[	2	4	m	
<i>Decimal:</i>	27	91	50	52	109	
<i>Hexadecimal:</i>	1B	5B	32	34	6D	

Cancel the underline function enabled with control command ESC [ 4 m or ESC [ 2 m.

ESC [ 2 m					Enable Underline
<i>ASCII:</i>	ESC	[	2	m	
<i>Control:</i>	CTRL [	[	2	m	
<i>Decimal:</i>	27	91	50	109	
<i>Hexadecimal:</i>	1B	5B	32	6D	

Selects the underline function. All succeeding print characters are underlined until the function is disabled with control command ESC [ 2 4 m or ESC [ Ø m.

ESC [ Ø m					Disable Underline
<i>ASCII:</i>	ESC	[	Ø	m	
<i>Control:</i>	CTRL [	[	Ø	m	
<i>Decimal:</i>	27	91	48	109	
<i>Hexadecimal:</i>	1B	5B	30	6D	

Cancel the underline function enabled with control command ESC [ 4 m or ESC [ 2 m.

## SPECIAL PRINTHEAD MOVEMENT

ESC [ (n) `					Set Active Column to Column n
<i>ASCII:</i>	ESC	[	(n)	`	
<i>Control:</i>	CTRL [	[	(n)	`	
<i>Decimal:</i>	27	91	(n)	96	
<i>Hexadecimal:</i>	1B	5B	(n)	60	

Causes the next character to be printed in Column n. The character following n is the grave accent (see ASCII data byte value 96 decimal).

BS		Backspace
<i>ASCII:</i>	BS	
<i>Control:</i>	CTRL H	
<i>Decimal:</i>	8	
<i>Hexadecimal:</i>	08	

Causes the active column to move to the left one space. If the active column is at the left margin, the backspace command is ignored.

ESC [ (n) a					Advance n Columns
<i>ASCII:</i>	ESC	[	(n)	a	
<i>Control:</i>	CTRL [	[	(n)	a	
<i>Decimal:</i>	27	91	(n)	97	
<i>Hexadecimal:</i>	1B	5B	(n)	61	

Advances the active column n number of columns.

If Linefeed/Newline is enabled, attempting to move the active column more than one column right of the right margin executes a linefeed/newline.

## PRINT DIRECTION

ESC [ ? 4 1 h							Unidirectional Printing
<i>ASCII:</i>	ESC	[	?	4	1	h	
<i>Control:</i>	CTRL [	[	?	4	1	h	
<i>Decimal:</i>	27	91	63	52	49	104	
<i>Hexadecimal:</i>	1B	5B	3F	34	31	68	

Begins unidirectional printing. Data are printed only when the printhead is moving left to right. Printing this way improves vertical character alignment.

Unidirectional printing remains in effect until reset with ESC [ ? 4 1 l.

*Note:* If set to ON, "PRINTSTYLE, Bi-Directional Graphics / NLQ in the configuration menu overrides unidirectional printing.

ESC [ ? 4 1 l							Bidirectional Printing
<i>ASCII:</i>	ESC	[	?	4	1	l	
<i>Control:</i>	CTRL [	[	?	4	1	l	
<i>Decimal:</i>	27	91	63	52	49	108	
<i>Hexadecimal:</i>	1B	5B	3F	34	31	6C	

Begins bidirectional printing. Data are printed when the printhead is moving in either direction. This is the default print mode. It remains in effect until reset by ESC [ ? 4 1 h.

## TABS

ESC H or ESC 1			Set Horizontal Tab at Current Column <sup>3</sup>		
<i>ASCII:</i>	ESC	H			
<i>Control:</i>	CTRL [	H			
<i>Decimal:</i>	27	72			
<i>Hexadecimal:</i>	1B	48			
<i>ASCII:</i>	ESC	1			
<i>Control:</i>	CTRL [	1			
<i>Decimal:</i>	27	49			
<i>Hexadecimal:</i>	1B	31			

Adds a horizontal tab at the current column, but not at a physical position on the paper.

Both control commands perform the same function.

ESC [ g or ESC [ Ø g			Clear Horizontal Tab at Current Column <sup>†</sup>		
<i>ASCII:</i>	ESC	[	g		
<i>Control:</i>	CTRL [	[	g		
<i>Decimal:</i>	27	91	103		
<i>Hexadecimal:</i>	1B	5B	67		
<i>ASCII:</i>	ESC	[	Ø	g	
<i>Control:</i>	CTRL [	[	Ø	g	
<i>Decimal:</i>	27	91	48	103	
<i>Hexadecimal:</i>	1B	5B	30	67	

Clears horizontal tab at current column.

Both control commands perform the same function.

---

<sup>3</sup> Changing horizontal character pitch also changes the physical position of tab stops. These commands only set or clear the tabs. The Horizontal Tab control code, HT, causes the active column to advance to subsequent tab positions.

Selecting or cancelling font pitches, changing the print quality to draft or NLQ, or changing the print area also changes the physical position of the tabs.

ESC [ (n) u					Set Horizontal Tab at Column n <sup>4</sup>
<i>ASCII:</i>	ESC	[	(n)	u	
<i>Control:</i>	CTRL [	[	(n)	u	
<i>Decimal:</i>	27	91	(n)	117	
<i>Hexadecimal:</i>	1B	5B	(n)	75	

Adds a horizontal tab at Column n.

ESC [ (n1) ; (n2) ; ... (n16) u								Set Multiple Horizontal Tabs <sup>§</sup>
<i>ASCII:</i>	ESC	[	(n1)	;	(n2)	;	...(n16)	u
<i>Control:</i>	CTRL [	[	(n1)	;	(n2)	;	...(n16)	u
<i>Decimal:</i>	27	91	(n1)	59	(n2)	59	...(n16)	117
<i>Hexadecimal:</i>	1B	5B	(n1)	3B	(n2)	3B	...(n16)	75

Adds multiple horizontal tabs at Columns n1, n2, etc. A maximum of 16 horizontal tabs may be set with one command.

ESC 2 or ESC [ 2 g or ESC [ 3 g					Clear All Horizontal Tabs <sup>§</sup>
<i>ASCII:</i>	ESC	2			
<i>Control:</i>	CTRL [	2			
<i>Decimal:</i>	27	50			
<i>Hexadecimal:</i>	1B	32			
<i>ASCII:</i>	ESC	[	2	g	
<i>Control:</i>	CTRL [	[	2	g	
<i>Decimal:</i>	27	91	50	103	
<i>Hexadecimal:</i>	1B	5B	32	67	
<i>ASCII:</i>	ESC	[	3	g	
<i>Control:</i>	CTRL [	[	3	g	
<i>Decimal:</i>	27	91	51	103	
<i>Hexadecimal:</i>	1B	5B	33	67	

Clears all previously set horizontal tabs. All three control commands perform the same function.

---

<sup>4</sup> Changing horizontal character pitch also changes the physical position of tab stops. These commands only set or clear the tabs. The Horizontal Tab control code, HT, causes the active column to advance to subsequent tab positions.

Selecting or cancelling font pitches, changing the print quality to draft or NLQ, or changing the print area also changes the physical position of the tabs.

HTS	Horizontal Tab Set*
ASCII: HTS Control: not applicable Decimal: 136 Hexadecimal: 88	

Performs the same function as ESC H and ESC 1. Adds a horizontal tab at a column, but not at a physical position on the page. HTS is valid only if the upper data bytes have been enabled by selecting "8 Bit DEC" in the configuration menu and if the C1 control codes have been enabled using ESC SP 7.

HT	Horizontal Tab
ASCII: HT Control: CTRL I Decimal: 9 Hexadecimal: 09	

Causes the active column to advance to the next horizontal tab position to the right of the current column. If there are no tabs to the right of the current column, the active column becomes the column after the right margin.

VTs	Vertical Tab Set*
ASCII: VTS Control: not applicable Decimal: 138 Hexadecimal: 8A	

Adds a vertical tab at the current line. Vertical tabs are set at line numbers not at physical locations on the page. VTS is valid only if the upper data bytes have been enabled by selecting "8 Bit DEC" in the configuration menu and if the C1 control codes have been enabled using ESC SP 7.

---

\* Changing horizontal character pitch also changes the physical position of tab stops. These commands only set or clear the tabs. The Horizontal Tab control code, HT, causes the active column to advance to subsequent tab positions.

Selecting or cancelling font pitches, changing the print quality to draft or NLQ, or changing the print area also changes the physical position of the tabs.

ESC J or ESC 3			Set Vertical Tab at Current Line <sup>5</sup>	
<i>ASCII:</i>	ESC	J		
<i>Control:</i>	CTRL [	J		
<i>Decimal:</i>	27	74		
<i>Hexadecimal:</i>	1B	4A		
<i>ASCII:</i>	ESC	3		
<i>Control:</i>	CTRL [	3		
<i>Decimal:</i>	27	51		
<i>Hexadecimal:</i>	1B	33		

Adds a vertical tab at the current line. Vertical tabs are set at line numbers, not physical locations on the page. Both control commands perform the same function.

ESC [ 1 g			Clear Vertical Tab at Current Line**	
<i>ASCII:</i>	ESC	[	1	g
<i>Control:</i>	CTRL [	[	1	g
<i>Decimal:</i>	27	91	49	103
<i>Hexadecimal:</i>	1B	5B	31	67

Clears the vertical tab at the current line. Vertical tabs at other lines are unaffected.

ESC [ (n) v			Set Vertical Tab at Line n**	
<i>ASCII:</i>	ESC	[	(n)	v
<i>Control:</i>	CTRL [	[	(n)	v
<i>Decimal:</i>	27	91	(n)	118
<i>Hexadecimal:</i>	1B	5B	(n)	76

Add a vertical tab at Line n. Vertical tabs are set at line numbers, not physical locations on the page.

---

<sup>5</sup> Changing line spacing also changes the physical position of tab stops

These commands only set or clear the tabs. The vertical tab control code, VT, causes the active line to advance to subsequent tab positions.

ESC [ (n1) ; (n2) ; ...(n15) v							Set Multiple Vertical Tabs <sup>6</sup>
<i>ASCII:</i>	ESC	[	(n1)	;	(n2)	;	...(n15) v
<i>Control:</i>	CTRL [	[	(n1)	;	(n2)	;	...(n15) v
<i>Decimal:</i>	27	91	(n1)	59	(n2)	59	...(n15) 118
<i>Hexadecimal:</i>	1B	5B	(n1)	3B	(n2)	3B	...(n15) 76

Adds multiple vertical tabs at Columns n1, n2, etc. You may set up to a maximum of 15 vertical tabs with the use of one command. Vertical tabs are set at line numbers, not physical locations on the page.

ESC 4 or ESC [ 4 g					Clear All Vertical Tabs <sup>††</sup>	
<i>ASCII:</i>	ESC	4				
<i>Control:</i>	CTRL [	4				
<i>Decimal:</i>	27	52				
<i>Hexadecimal:</i>	1B	34				
<i>ASCII:</i>	ESC	[	4	g		
<i>Control:</i>	CTRL [	[	4	g		
<i>Decimal:</i>	27	91	52	103		
<i>Hexadecimal:</i>	1B	5b	34	67		

Clears all previously set vertical tabs. Both control commands perform the same function.

VT		Vertical Tab
<i>ASCII:</i>	VT	
<i>Control:</i>	CTRL K	
<i>Decimal:</i>	11	
<i>Hexadecimal:</i>	0B	

Causes the active line to advance to the next vertical tab on the current page. If there are no more vertical tabs on the current page, the active line is set at the top margin on the next page.

If Linefeed/Newline mode is enabled, the active column is also returned to the left margin.

---

<sup>6</sup> Changing line spacing also changes the physical position of tab stops.

These commands only set or clear the tabs. The vertical tab control code, VT, causes the active line to advance to subsequent tab positions.



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# Appendix A— Specifications

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The printer employs three printheads. Each printhead contains one row of nine wires arranged vertically. The printheads are fastened to a shuttle or carriage assembly.

Two carriage assemblies are offered:

- **Wide Carriage.** In 10 pitch draft mode at 6 lpi, the wide carriage is optimized to support a throughput of 300 lpm over 132 columns; in NLQ mode, it supports a throughput of 75 lpm.
- **Narrow Carriage.** In 10 pitch draft mode at 6 lpi, the narrow carriage is optimized to support a throughput of 400 lpm over 80 columns; in NLQ mode, it supports a throughput of 100 lpm.

Both models can print a 13.6-in. line of characters or graphics.

This appendix deals with specifications. These include the printer's characteristics, safety features, reliability, physical features, and requirements.

*Note:* All specifications in this appendix are subject to change without notice.

## CHARACTERISTICS

Throughput				
<u>Pitch</u>	<b>Wide Model*</b>		<b>Narrow Model**</b>	
	<u>Draft</u>	<u>NLQ</u>	<u>Draft</u>	<u>NLQ</u>
10	300 lpm	75 lpm	400 lpm	100 lpm
12	191 lpm	62 lpm	281 lpm	83 lpm
15	185 lpm	N/A	285 lpm	N/A
16.67	118 lpm	N/A	193 lpm	N/A
18.2	118 lpm	N/A	183 lpm	N/A
<p>* Printing 6 lines per in. on a 132 character column.</p> <p>** Printing 6 lines per in. on an 80 character column.</p>				
Printing Mechanism				
Printing Direction	Bidirectional, short-line logic seeking: normally bidirectional (or selectable as unidirectional) for text; unidirectional for graphics.			
Printheads	Type	Dot-matrix impact using ballistic wire driven through ruby guides.		
	Number of Heads	3		
	Horizontal Distance Between Printheads	Wide Carriage: 4.4 in. on centers Narrow Carriage: 2.8 in. on centers		
	Number of Wires Per Head	9		

## CHARACTERISTICS, CONTINUED

Printing Mechanism, continued		
	Diameter of Wire	0.014 in. (0.356 mm)
	Duty Cycle	<ul style="list-style-type: none"> <li>No limitation when printing rolling ASCII characters</li> <li>60 lines at 136 characters per line when printing same character</li> </ul>
Printhead Carriage	Wide Carriage	Optimized for 13.2-in.-wide column
	Narrow Carriage	Optimized for 8.0-in.-wide column
	Line Length	Up to 13.6 in. with either narrow or wide carriage
Copies		
Original + 5 copies, max. (See "Paper" Requirements.)		
Paper Feed		
Paper Feed Method	Adjustable pull tractors for continuous forms	
Paper Path	Front and bottom loading	

## CHARACTERISTICS, CONTINUED

Paper Feed, continued		
Paper Handling Capacity	Total thickness must not exceed 0.018 in. (0.46 mm), based on following requirements. (See "Paper" Requirements.)	
	<b>Width</b>	<b>Bond Weight</b>
	<b>Single-Part Paper:</b>	3.0 to 16.0 in. 14 to 28 lb (52 to 105 g/m <sup>2</sup> )
	<b>Multipart-Part Paper: (Each Sheet)</b>	3.0 to 16.0 in. 11 to 21 lb* (40 to 80 g/m <sup>2</sup> )
Label Handling Capacity	Total thickness: must not exceed 0.007 in. (0.18 mm), based on width range of 3.0 to 16.0 in., with no trimming. (See "Label" Requirements.)	
Line Spacing (Vertical Pitch, in Lines / In.)	<ul style="list-style-type: none"> <li>• Menu Selectable: 6 to 8 lpi.</li> <li>• Universal control Commands: 144 to 144/170 lpi.</li> <li>• Epson/IBM Control Commands: 216 to 216/255 lpi.</li> <li>• DEC Control Commands: 2, 3, 4, 6, 8, or 12 lpi.</li> <li>• Switch Panel. 1/6 in., 1/8 in., 1/144 in.</li> </ul>	
Line Feed Increments	<ul style="list-style-type: none"> <li>• Universal Control Commands. 1/144 in., n = 1 to 170</li> <li>• Epson/IBM Control Commands: 1/216 in., n = 1 to 255</li> <li>• DEC Control Commands. 1/2, 1/3, 1/4, 1/6, 1/8, 1/12 in.</li> </ul>	

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\* Varies among first, middle, and last parts.

## CHARACTERISTICS, CONTINUED

Paper Feed, continued		
Line Feed Direction	Forward in linefeed increment specified above. ( <sup>1</sup> / <sub>144</sub> in. increments in reverse direction.)	
Form Length	0.5 to 31.5 in. (12.7 to 800 mm) in 0.5 in. increments using menu*. Also, 420 mm, 297 mm, 210 mm, 148.5 mm, and 11 <sup>2</sup> / <sub>3</sub> in.	
Slew Rate	Selectable: 11 or 5 in. per second	
Ribbon		
Type Cartridge	Nylon ribbon, <sup>1</sup> / <sub>2</sub> in. wide, black Disposable, full-carriage length cassette, approx. 3 in. x 4 in. x 20 in. Clean-hands installation.	
Ribbon Life	6 million draft-mode characters	
Emulations		
<ul style="list-style-type: none"><li>• Epson FX-100</li><li>• IBM Proprinter XL</li><li>• DEC LA210</li></ul>		
Character Sets		
Control Code Maps	Epson IBM DEC	Standard Epson Map IBM #1 and IBM #2 C0 and C1

---

\* Other form lengths are available using emulation control commands. The DEC LA210 emulation also contains a No Form mode selected by a control command.

## CHARACTERISTICS, CONTINUED

Character Sets, continued		
Character Code Maps	ASCII	Standard 96-Character ASCII*
	Epson	96-Character Epson National-Use **, including : <div> <div>U.S.</div> <div>France</div> <div>Germany</div> <div>U.K.</div> <div>Denmark</div> <div>Sweden</div> <div>Italy (Epson)</div> <div>Spain</div> </div> <div> <div>Japan</div> <div>Norway</div> <div>Denmark II</div> <div>Spain II</div> <div>Latin America</div> <div>Hebrew</div> <div>Italy (ANSI)</div> </div>
	IBM	Code Page 437 (U.S.), Code Page 437 (Hebrew), Code Page 850 (Multilingual), Code Page 860 (Portugal)†

---

\* All emulations support the standard ASCII character map.

\*\* Also adapts to an Epson National-Use Standard Code Page using Epson control commands.

† All also adapt to an IBM All-Character Character Set (PC-8) using IBM control commands.

## CHARACTERISTICS, CONTINUED

Character Sets, continued		
	DEC	DEC National-Use, including : Canada   Italy (ANSI)   Spain Finland   Hebrew       U.K. France    Sweden U.S. Germany Norway/Denmark DEC Multilingual DEC VT100 Line Draw  OCR A, OCR B, Downloaded Characters <sup>††</sup>
	Overlays	
Human-Readable Fonts (Text Characters)		
Character Modes	NLQ (10, 12, and 15 pitches only) and Draft	
ROM Character Library	428 Printable Draft Characters; 428 Printable NLQ Characters. Library includes Space Character.	
Fixed Pitches (Characters/In.)	5, 6, 7.5, 8.33, 8.57, 9.1, 10 (Pica), 12 (Elite), 15, 16.67, 17.14 (Pica Condensed), 18.2 (Elite Condensed)	
Typeface	Nonproportional typewriter face and OCR	
Typestyle	Upright, Italics, Condensed, Enlarged	

<sup>††</sup> Download characters for overlaying using universal control commands.

## CHARACTERISTICS, CONTINUED

Human-Readable Fonts, continued					
Weight	Normal Stroke, Emphasized (Bold)				
Download Characters	Supported				
Text Composition					
		<b>Pitch</b>	<b>Dot Configuration</b>		<b>Dot Size</b>
			<b>Char.</b>	<b>Graphics</b>	<b>(Dia.)</b>
	<b>Draft</b>	10	9 x 7	9 x 12	1/100 in.
	<b>(ROM Resident)</b>	12	9 x 7	9 x 12	1/120 in.
		15	9 x 7	9 x 12	1/150 in.
		17.14	9 x 7	9 x 12	1/166 in.
		18.2	9 x 7	9 x 12	1/182 in.
	<b>NLQ</b>	10	18 x 14	18 x 24	1/200 in.
	<b>(ROM Resident)</b>	12	18 x 14	18 x 24	1/240 in.
		15	18 x 14	18 x 24	1/300 in.
	<b>Download Draft</b>	—	—	—	1/120 in.
	<b>Download NLQ</b>	—	—	—	1/240 in.
Barcodes					
Styles	Code 3 of 9, EAN-8, EAN-13, UPC-A, UPC-E, Interleaved 2 of 5, PostNet, Codabar				
Height	1/12 in. to 10 in. in 1/12 in. increments				
Bar Width	0.014 in., min.				



## CHARACTERISTICS, CONTINUED

Barcodes, continued	
Space Width	0.014 in., min.
Intercharacter Gap	0.014 in., min.
Weight	Single and Double Strike
Density	75 and 100 dpi
Graphics	
Graphics Technique	Bit-image, dot-addressable
Graphic Resolution	Single Density: 1/60 in. dia. Double Density: 1/120 in. dia. Quadruple Density: 1/240 in. dia.
Serial Interface*	
Type	RS-232-C (RS-422-A optional)
Protocol	DTR, X-ON/X-OFF, or ETX/ACK
Baud	1200, 2400, 4800, 9600, or 19200
Data Bits	7 or 8
Parity	Even, Odd, Mark, Space, or None
Stop Bits	1 or 2

---

\* See Appendix B for details.

## CHARACTERISTICS, CONTINUED

Parallel Interface*	
Centronics Compatible	Selectable initialize sensitivity
Memory Configuration	
RAM	32K x 8 for download characters and input buffer
EPROM	128K x 8 firmware

## SAFETY FEATURES

Your printer has the following safety features:

- Printer prints at half speed when printing 10 pitch if the operator access door is open.
- All electrically conductive materials are grounded.

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\* See Appendix C for details.

## RELIABILITY

<b>Printhead Life Expectancy:</b>	500 million characters per printhead
<b>Mean Time Between Failures (MTBF):</b>	9000 power-on hr. at 15% duty cycle and 32% print density per page
<b>Mean Time to Repair (MTTR):</b>	.5 hr.

## PHYSICAL

<b>Height:</b>	6.02 in. (153 mm), without acoustic hood
<b>Width:</b>	27.38 in. (695.5 mm)
<b>Depth:</b>	16.7 in. (424 mm) without acoustic hood
<b>Weight (out of box):</b>	45 lb (20.5 kg), max.
<b>Shipping Weight:</b>	52 lb (23.6 kg) max.
<b>Acoustic Level (ISO 7779):</b>	65 dBA, max, without acoustic hood and stand 55 dBA, max, with acoustic hood and stand 0 dBA in standby mode (power on but not printing)

## REQUIREMENTS

### ELECTRICAL

<b>Voltage:</b>	110, 120, 220, or 240 vac
<b>Frequency:</b>	50/60Hz $\pm$ 3Hz
<b>Power Consumption:</b>	Standby: less than 30 w Printing: 200 w, max. printing rolling ASCII characters
<b>Leakage Current:</b>	0.0058 ma, max.

### ENVIRONMENTAL

<b>Temperature:</b>	Operating: 50° to 100° F (approx. 10° to 40° C) Non-Operating: -40° to 150° F (approx. -40° to 65° C)
<b>Humidity:</b>	Operating: 20% to 80% and noncondensing Non-Operating: 10% to 90% and noncondensing
<b>Altitude:</b>	Operating: -400 ft to 10,000 ft (approx. -125 m to 3000 m) above MSL Non-Operating: -400 ft to 40,000 ft (approx. -125 m to 12,000 m) above MSL
<b>Miscellaneous:</b>	Avoid exposure to water, toxic chemicals, or corrosive substances.

### INTERFACE

See Appendixes B and C for serial and parallel interface signals and cable requirements.

## PAPER

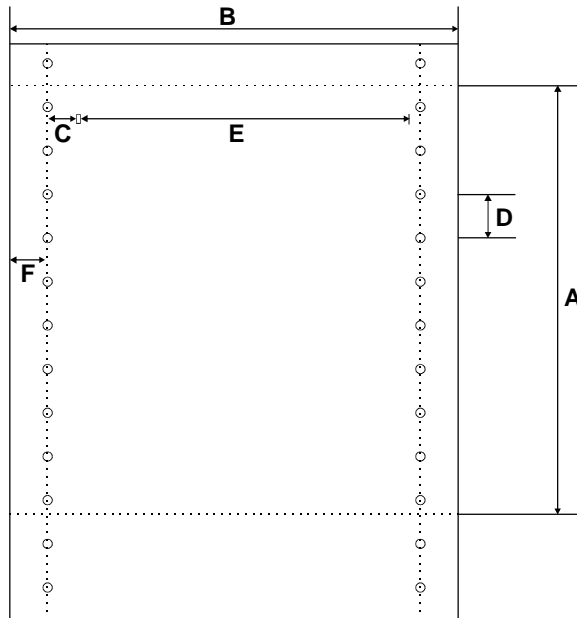
**Note:** The printer may not operate reliably or efficiently with all possible forms that fit the paper requirements specified below.

**Bond Weight:** The following table applies to single and multipart forms. Multipart forms are understood to be any carbonless or carbon-backed paper.

Layer	Top sheet	2nd	3rd	4th	5th	6th	7th	8th	Total thickness	Width
No. of sheets										
Single-part	14-28 lb 52-105 g/m2 45-90 kg/ream	_____	_____	_____	_____	_____	_____	_____	0.002-0.005 in. (0.065-0.13 mm)	16.0 in. max.
2-part	11-17 lb 40-64 g/m2 34-55 kg/ream	11-21 lb 40-80 g/m2 34-70 kg/ream	_____	_____	_____	_____	_____	_____	0.015 in. max. (0.38 mm)	
3-part	11-14 lb 40-52 g/m2 34-45 kg/ream	11-21 lb 40-80 g/m2 34-48 kg/ream	_____	_____	_____	_____	_____	_____		
4-part	11-14 lb 40-52 g/m2 34-45 kg/ream	11-21 lb 40-56 g/m2 34-48 kg/ream	_____	_____	_____	_____	_____	_____		
5-part	11-14 lb 40-52 g/m2 34-45 kg/ream	11-21 lb 40-56 g/m2 34-48 kg/ream	_____	_____	_____	_____	_____	_____		
6-part	11-14 lb 40-52 g/m2 34-45 kg/ream	11-21 lb 40-56 g/m2 34-48 kg/ream	_____	_____	_____	_____	_____	_____		

**Note:** g/m<sup>2</sup>: Weight of a sheet of paper 39.37 x 39.37 in. (1000 x 1000 mm)  
kg/ream: Weight of 1000 sheets of paper 31.02 x 42.95 in. (788 x 1091 mm)  
lb: Weight of 500 sheets of paper 17 x 22 in.: (431.8 x 558.8 mm)

For example, 64 gm<sup>2</sup> = 55 kg/ream = 17 lb

**Size and Print Area:**

Symbol	Description	Specification
A	Form Length*	0.5 to 31.5 in. (approx. 12.7 to 800 mm) in ½ in. inc.
B	Paper Width	3 to 16 in. (approx. 76.2 to 406.4 mm)
C	1st Character Column	0.55 to 0.88 in. (approx. 14 to 22.35 mm)
D	Vertical Sprocket Spacing	0.50 in.
E	Print Area	13.6 in. (approx. 342.9 mm), max.
F	Horizontal Sprocket Position	0.25 in. or 6.00 mm

\* Form length as selected in the configuration menu. The actual paper length is continuous. Longer form lengths and a No Form mode are available in some emulations.

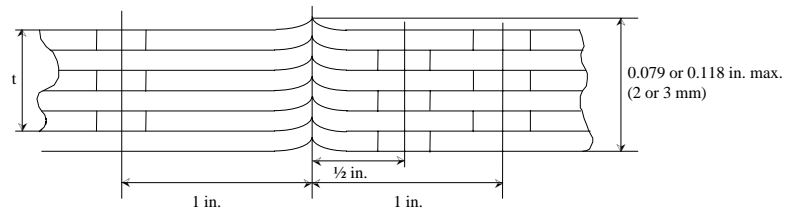
**Multipart Forms:**

Multiple-part forms should be secured on both sides with glue or crimp fasteners.

Paper. When using multipart forms, consider the following:

- When the forms are unfolded, the height of the bulge at the outfold should not exceed the following, depending upon the forms' thickness:

Total thickness (t) of forms	Allowable height of bulge
$t \leq 0.012$ in. (0.3 mm)	0.079 in. (2 mm)
$0.012$ in. $< t \leq 0.022$ in. (0.3 mm $< t < 0.55$ mm)	0.118 in. (3 mm)



This limitation applies to the multipart forms fastened with any method.

- The maximum displacement of the center of the sprocket holes between sheets shall not exceed 0.5 mm.

Gluings. Gluing specifications for multipart forms are as follows:

- Spot gluing should be applied along both sides.
- Spot-gluing should be applied at the alternate positions from the top to bottom sheet.
- Glue should be applied evenly without wrinkling or creasing.
- Paper thickness change due to gluing should not exceed 0.05 mm.

Crimp Fastening. Crimp specifications for multipart forms are as follows:

- Double crimp fasteners (4-tail) should be applied to the same positions on both sides of the forms. (See the figure on the next page.)

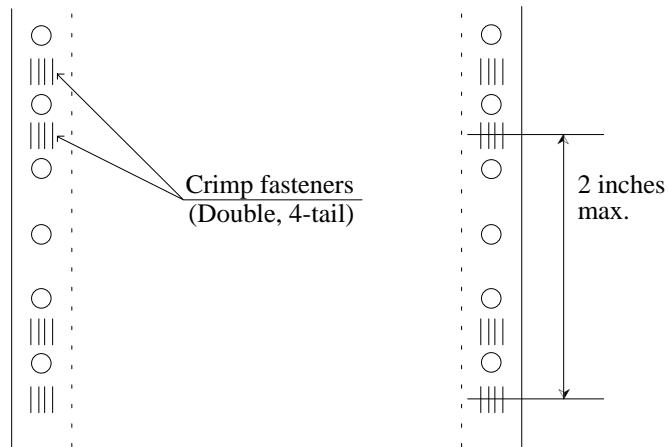
Single crimp fasteners (4-tail) are also acceptable.

- In consideration of displacement between the top and bottom layers, a spacing of at least  $\frac{1}{3}$  in. should be used for form design.
- Displacement between sheets in 5-part forms should not exceed 2.2 mm in self-print testing.
- The combination of gluing on one side and crimp fasteners on the other side is allowed.
- The crimp fastener pitch should be a maximum of 2 in.

When the total thickness of forms is 0.3 mm or less and the paper width is 10 in. or less, a pitch of 3 in. is allowed.



- Metallic fasteners must not be used.

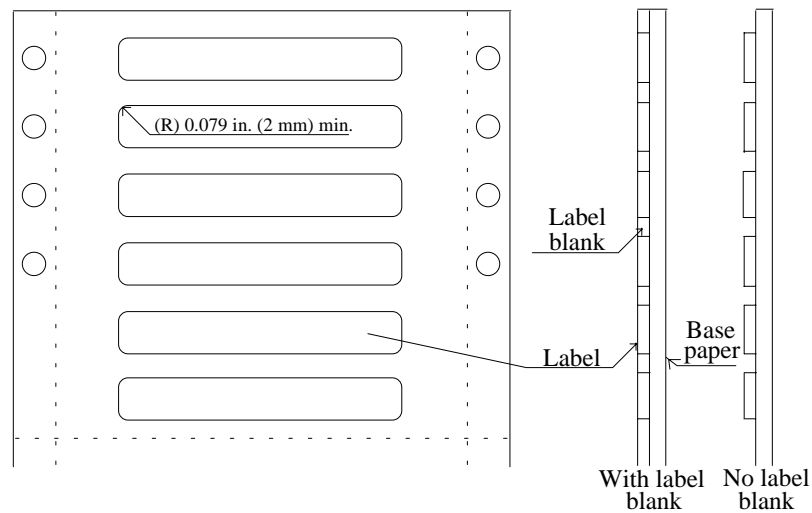


Sprocket Holes and Perforations. Sprocket hole and perforation specifications for multipart forms are as follows:

- The sprocket holes should be clearly and cleanly cut.
- Forms should be fanfolded at every horizontal perforated line.
- Both edges of each perforation should not be torn.
- Intersection of the horizontal and vertical perforations should not be cut.

**Labels:**

Label size and print area are shown in the following illustration.



- The total thickness of label and base paper should not exceed 0.18 mm.
- Label forms shall not be left in the printer.
- The label adhesion should be so strong that no label comes off or partially separates from the base paper after a label form has been left in the printer for 72 hours at room temperature.
- Feed labels only from the bottom.
- The temperature range allowable for label printing is 40° F to 95° F (5° C to 35° C).

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# Appendix B— Serial Interface

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This appendix deals with RS-232-C (and RS-422-A) serial interface connectivity.

## SERIAL INTERFACE BASICS

RS-232-C, commonly referred to as RS-232, is a serial interface communication standard developed by the Electronics Industries Association (EIA) which defines communication signals, pin assignments, and voltage levels.

The standard divides equipment into two categories:

- Data Terminal Equipment (DTE)
- Data Communication Equipment (DCE)

The two types of equipment are distinguished by their signals and pin assignments, as shown in the table on the following page:

- DTE devices transmit on Pin 2
- DCE devices transmit on Pin 3

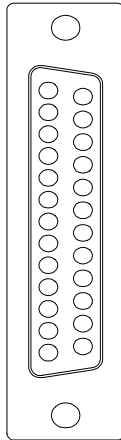
Computers and serial printers are usually DTE devices. Modems and communication controllers are usually DCE devices.

The RS-232-C standard specifies more signals than are used, or needed, in most data communication applications. However, for reference, the table on the following page lists all communication signals, their

abbreviations, and pin assignments. The direction of the arrow indicates whether the signal is an input or output of the device.

Pin assignments are specified for 25-pin D-type connectors. The RS-232-C standard does not specify pin assignments for serial communication on 9-pin connectors.

Only nine of the 25 RS-232-C signals are commonly used in serial connections. These nine are listed in the table on Page B-4.



Serial Port Connector

JB0-BL

RS-422-A serial interface is optional. RS-422-A serial connectivity involves differential drivers and receivers for extended computer-to-printer distances, depending on the baud. RS-422-A signals are not implemented on the standard printer.

DTE Device			DCE Device	
Pin #		Signal	Abbreviation	Pin #
1		Frame Ground	FG	1
2	→	Transmitted Data	TxD	→ 2
3	←	Received Data	RxD	← 3
4	→	Request To Send	RTS	→ 4
5	←	Clear To Send	CTS	← 5
6	←	Data Set Ready	DSR	← 6
7		Signal Ground	SG	7
8	←	Data Carrier Detect	DCD	← 8
9	←	Pos. DC Test Voltage	+V	← 9
10	←	Neg. DC Test Voltage	-V	← 10
11	←	Equalizer Mode	QM	← 11
12	←	Sec. Data Carrier Detect	(S)DCD	← 12
13	←	Sec. Clear To Send	(S)CTS	← 13
14	→	Sec. Transmitted Data	(S)TD	→ 14
15	←	Transmitter Clock	TC	← 15
16	←	Sec. Received Data	(S)RD	← 16
17	←	Receiver Clock	—	← 17
18		Unassigned		18
19	→	Sec. Request To Send	(S)RTS	→ 19
20	→	Data Terminal Ready	DTR	→ 20
21	←	Signal Quality Detect	SQ	← 21
22	←	Ring Indicator	RI	← 22
23	→	Data Rate Selector	—	→ 23
24	→	Ext. Transmitter Clock	(TC)	→ 24
25		Unassigned	—	25

### EIA RS-232-C Pin Assignments

DTE Device			DCE Device	
Pin #		Signal	Abbreviation	Pin #
1		Frame Ground	FG	1
2	→	Transmitted Data	TxD	→ 2
3	←	Received Data	RxD	← 3
4	→	Request To Send	RTS	→ 4
5	←	Clear To Send	CTS	← 5
6	←	Data Set Ready	DSR	← 6
7		Signal Ground	SG	7
8	←	Data Carrier Detect	DCD	← 8
20	→	Data Terminal Ready	DTR	→ 20

### Common RS-232-C

Note that two signal names in this group, Transmitted Data and Received Data, are defined from the perspective of the DTE device. The same terms are used, however, for DCE devices. For DTE devices, the Transmitted Data signal is assigned to Pin 2 and is a data output; for DCE devices, the Transmitted Data signal is also assigned to Pin 2, but is a data input.

To avoid confusion, note that Transmitted Data and Received Data are misleading terms when used to describe DCE signals. The following chart defines these and the other nine common RS-232-C signals in relationship to DTE and DCE devices.

DTE DEVICE			DCE DEVICE		
Pin	Signal Name	Function	Pin	Signal Name	Function
1	Frame Ground (FG)	Frame Ground	1	Frame Ground (FG)	Frame Ground
2	Transmitted Data (TxD)	Output. Data signal. Transmits serial data on this pin.	2	Transmitted Data (TxD)	Input. Data signal. Receives transmitted data on this pin.
3	Received Data (RxD)	Input. Data signal. Receives serial data on this pin.	3	Received Data (RxD)	Output. Data signal. Transmits serial data on this pin.
4	Request To Send (RTS)	Output. Control signal. DTE has data to send and is requesting permission to transmit by placing this pin high.	4	Request To Send (RTS)	Input. Control signal. DCE looks for positive voltage on this pin indicating other device has data to send.
5	Clear To Send (CTS)	Input. Control signal. DTE looks for a positive voltage on this pin as permission to transmit data.	5	Clear To Send (CTS)	Output. Control signal. DCE grants permission for other device to transmit data by placing positive voltage on this line.
6	Data Set Ready (DSR)	Input. Control signal from other RS-232-C device that lets DTE know that the other RS-232-C device is powered up.	6	Data Set Ready (DSR)	Output. Control signal. DCE places positive voltage on this pin when powered up.
7	Signal Ground	Signal Ground. (Must be connected.)	7	Signal Ground	Signal Ground. (Must be connected.)
8	Data Carrier Detect (DCD)	Input. Control signal from other RS-232-C device that lets DTE know that circuit has been established.	8	Data Carrier Detect (DCD)	Output. Control signal. DCE places positive voltage on this pin when circuit has been established.
20	Data Terminal Ready (DTR)	Output. Control signal. DTE places positive voltage on this pin when powered up.	20	Data Terminal Ready (DTR)	Input. Control signal from other device that lets DCE know that other RS-232-C device is powered up.

### DTE/DCE Device Chart

With the exception of Frame Ground and Signal Ground, the nine signals can be categorized as data signals or control signals and are paired as shown below:

Data Signal Pair:	Pin 2	Transmitted Data	TxD
	Pin 3	Received Data	RxD
Control Signal Pair:	Pin 4	Request to Send	RTS
	Pin 5	Clear to Send	CTS
Control Signal Pair:	Pin 6	Data Set Ready	DSR
	Pin 20	Data Term. Ready	DTR

Pin 8, Data Carrier Detect, is also a control signal but it does not have a functional pair. Some situations require a high voltage on this input to allow communication. See "Making a Serial Cable" on Page B-9.



## SERIAL INTERFACE PIN-OUTS FOR PRINTER

The printer is a DTE device. The table that follows summarizes the pin assignments on the printer end of a serial interface.

Pin #		Signal Name	Abbr.	Comment
1		Frame Ground	FG	
2	→	Transmitted Data	TxD	
3	←	Received Data	RxD	
4	→	Request To Send	RTS	Always high; + 12v, signal level.
5	←	Clear To Send	CTS	<optional, not implemented>
6	←	Data Set Ready	DSR	<optional, not implemented>
7		Signal Ground	SG	
8				
9	→	RS-422-A TxD-	TxD 422-	<optional, not implemented>
10	→	RS-422-A TxD+	TxD 422+	<optional, not implemented>
11	→	Auxiliary DTR*	—	Same as Pin 20.
12				
13				
14				
15				
16				
17				
18	←	RS-422-A RxD+**	RxD 422+	<optional, not implemented>
19	→	Auxiliary DTR*	—	Same as Pin 20.
20	→	Data Terminal Ready	DTR	High until buffer fills, then low.
21				
22				
23				
24				
25				

\* Technically, not an RS-232-C signal. See "DTR Polarity" under Serial Options in the configuration menu. See "Handshaking" later in this appendix for more information.

\*\* RxD on Pin 3 is used as the differential complement RxD 422- of this signal line.

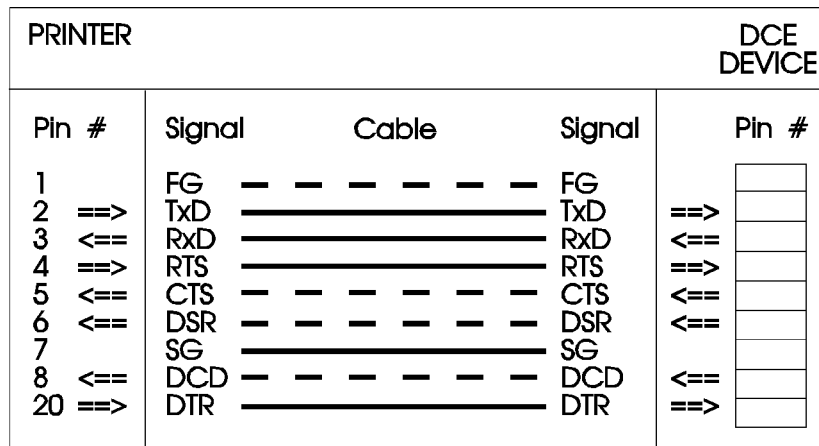
## **MAKING A SERIAL CABLE**

Interfacing two RS-232-C serial devices is simply a process of connecting grounds and tying together the output and input signal pairs.

The wiring diagrams on Page B-10 list the nine most commonly used RS-232-C serial interface signals and their pins versus the pin assignments on DCE and DTE devices. Most computers are DTE devices. Most modems, repeaters, and translators are DCE.

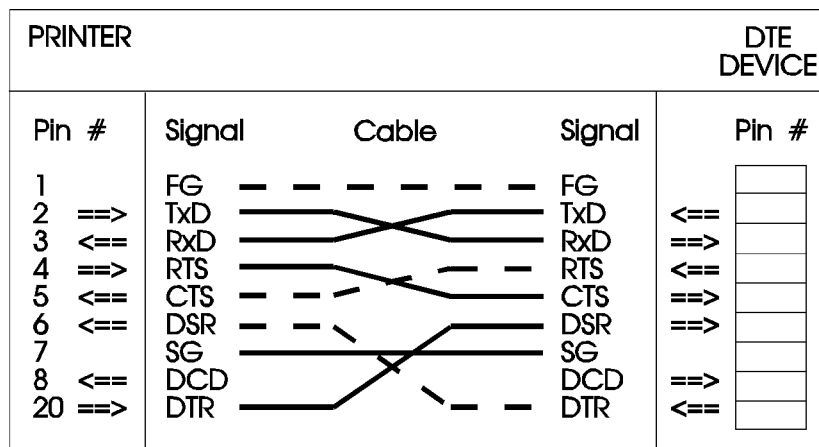
Connections that are usually required appear as solid lines. Connections that are normally optional appear as dashed lines. The full compliment of connections is sufficient for the majority of situations. For special cases, consult your device's technical reference manual.

Serial connectors come in two genders: male and female. A female connector is mounted on the printer. Use a male connector on the printer end of the cable.



Printer To DCE Device Wiring Diagram

AB0-AM



Printer To DTE Device Wiring Diagram

AB0-AN

To determine which wiring diagram to use, you must determine if the device is DTE or DCE. Locate a description of the target device's Transmitted Data signal and determine if it is an input or output. If Transmitted Data is an output, the device is DTE. Use the DTE wiring diagram. If Transmitted Data is an input, the device is DCE. Use the DCE wiring diagram.

To determine the pin assignments of other devices, refer to those devices' technical reference manuals. The serial interface pin assignments, functional description, signal direction, and control requirements are usually described.

If no documentation is available, a "break-out box" or an intelligent serial interface cable can determine which pins are used. (I.Q. Technology's Smart Cable, for example, is an intelligent serial interface cable.)

As pin assignments are determined, pin numbers should be written down on the appropriate wiring diagram on Page B-10. When you have written down all required pin assignments, you can then build the cable directly from the wiring chart.

Keep in mind that the actual pin number assigned to any signal may vary from device to device. For example, Pin 5 is the pin assigned to Signal Ground on the IBM PC/AT (or later) while Pin 7 is the pin assigned to Signal Ground on the IBM PC.

## CONNECTION EXAMPLES

Use the following examples as guides in building a serial interface cable. The following examples are presented:

- IBM PC to Printer
- IBM PC/AT to Printer

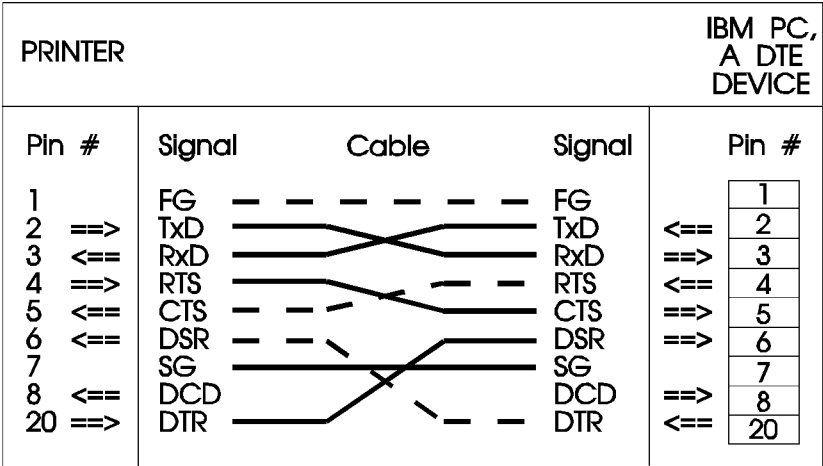
### IBM PC TO PRINTER

The wiring diagram on the following page shows how to connect an IBM PC, a DTE device, to the printer, also a DTE device. A DTE/DTE interface must make each side of the link seem as if it is receiving inputs from a DCE device. This is accomplished by making a cross-connected cable.

First, the Signal Ground on the printer is tied to the Signal Ground on the IBM PC; likewise, the Frame Grounds on the printer and IBM PC are tied together. Next, RxD on the printer (Pin 3) is tied to TxD (Pin 2) on the IBM PC; then TxD (Pin 2) on the printer is tied to RxD (Pin 3) on the IBM PC. Lastly, the control signals are connected: DTR (Pin 20) on the printer to DSR (Pin 6) on the IBM PC, and RTS (Pin 4) on the printer to CTS (Pin 5) on the IBM PC.

When the printer powers up, it always raises the voltage on its Pin 20, DTR, and maintains it in an elevated state. The PC receives this signal on Pin 6, DSR, and interprets it to mean that the printer is available.

When the PC has data to send, it looks for a high voltage input on its Pin 5, CTS, before sending data. The printer actually holds the voltage continuously high on its Pin 4, RTS, which is tied to the PC's Pin 5. Thus, the PC automatically begins sending data on its Pin 2 and continue until all data are sent or transmission is interrupted by a handshaking protocol.



IBM PC to Printer Wiring Diagram

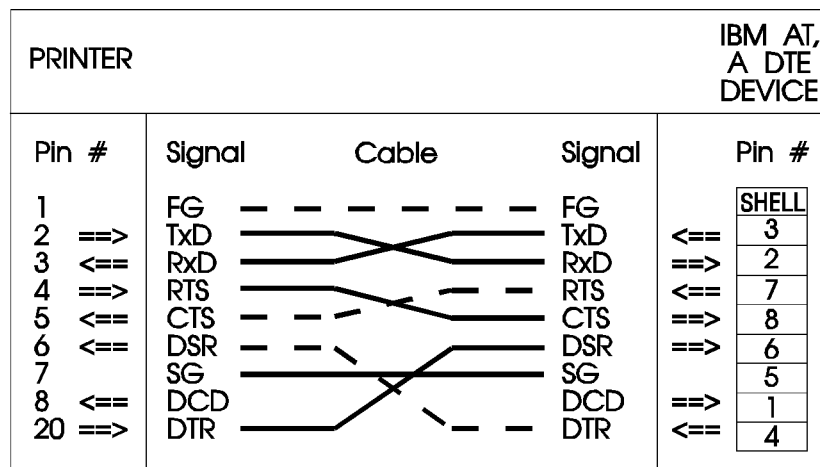
AB0-AO

**IBM PC/AT\* TO PRINTER**

The wiring diagram that follows shows how to connect an IBM PC/AT, a DTE device, to the printer, also a DTE device. It differs from the IBM PC example only in the pin numbers on the computer side. The IBM PC/AT uses a male, 9-pin, D-type serial connector.

\* Also 386s, 486s, etc.

First, the Signal Ground on the printer is tied to the Signal Ground on the IBM PC/AT; likewise, the Frame Grounds on the printer and IBM PC/AT are tied together. Next, RxD on the printer (Pin 3) is tied to TxD (Pin 3) on the IBM PC/AT; then TxD (Pin 2) on the printer is tied to RxD (Pin 2) on the IBM PC/AT. Lastly, the control signals are connected: DTR (Pin 20) on the printer to DSR (Pin 6) on the IBM PC/AT, and RTS (Pin 4) on the printer to CTS (Pin 8) on the IBM PC/AT.



IBM PC/AT to Printer Wiring Diagram

AB0-AP

## HANDSHAKING

Handshaking controls the data flow across the serial interface.

Control of the data flow is necessary because it is possible for computers to send data faster than the printer can print. The printer contains a data storage buffer to ease this potential problem, but data flow control is necessary to totally eliminate the possibility of data loss.

The printer provides two kinds of handshaking:

- Software handshaking
- Hardware handshaking

### SOFTWARE HANDSHAKING

Software handshaking occurs when a device controls data flow using the content of the data itself.

The printer supports two software handshaking protocols:

- X-ON/X-OFF
- ETX/ACK

#### X-ON/X-OFF

X-ON/X-OFF is commonly used when printers control the handshake.

The printer accepts characters until its input buffer is nearly full, at which time it initiates the handshake by sending a "turn-off" character, X-OFF, back to the computer. When the computer receives this character, it stops transmitting data. When the input buffer is nearly empty, the printer sends a "turn-on" character, X-ON, to the computer. Upon receipt of this character, the computer resumes sending characters.



In the configuration menu, you may select whether the printer sends an X-ON every 20 seconds during periods when it is ready to receive data (called robust) or only once.

X-ON is ASCII character decimal number 17, and X-OFF is ASCII character decimal number 19. These are sometimes referred to as device control 1 (DC1) and device control 3 (DC3), respectively.

### **ETX/ACK**

ETX/ACK is a commonly used when computers control the handshake.

The computer sends its characters line-by-line. After each line is sent, the computer puts in an END OF TEXT character, ETX. When the printer is ready to receive the next line of data, it sends an ACKNOWLEDGMENT character, ACK, back to the computer.

ETX is ASCII character decimal number 3, and ACK is ASCII character decimal number 6.

## **HARDWARE HANDSHAKING**

Hardware handshaking controls data transmission by changing the voltage level on a signal wire. Not all printers can respond to control characters embedded in the data stream (software handshaking).

Many printers use a pin on the connector to specify a "buffer full" condition. When the printer asserts its buffer-full line, data transmission stops.

The printer supports two hardware handshaking protocols:

- DTR
- BUSY (Inverse DTR)

### **DTR**

DTR handshaking protocol uses the DTR signal on Pin 20. The voltage remains high until the print buffer is 256 bytes from full, at which time DTR is set low. When the buffer is 2256 bytes from full (257 bytes if minimum buffer size is selected in the configuration menu), DTR resets to high and data transmission can resume.

### **BUSY (Inverse DTR)**

DTR is specified for Pin 20 of an RS-232-C serial interface. Used according to RS-232-C specifications, DTR is high when the printer is ready to receive new print data, and low when it is busy processing print data.

On the 4100 printer, DTR on Pin 20 is also wired to Pins 11 and 19. Some computer operating systems expect a signal called BUSY (or inverse DTR) on either Pin 11 or 19, in place of DTR. If used, BUSY is low when the printer is ready to receive new print data, and high when it is busy processing data. This is directly opposite of DTR.

Since DTR and BUSY are logical opposites, you can change the polarity of DTR in the configuration menu. Under Interface Options/Serial Options, change "DTR Polarity" from "High" (factory default) to "Low."

## **IF YOU CANNOT MAKE IT WORK**

If your printer-to-computer serial interface is not working, try the following:

- Check your computer manual's explanation of its RS-232-C serial interface and compare that to the printer's requirements.
- Make sure the serial interface cable is wired properly for data transfer on Pins 2 and 3, and that the control signals are properly matched for handshaking. (This may require using a serial interface "break out" box.)

An intelligent serial interface cable, like a "breakout" box, is designed to make these checks for you and electronically route the necessary signals to the proper pins. (I.Q. Technology's Smart Cable is one of these.)

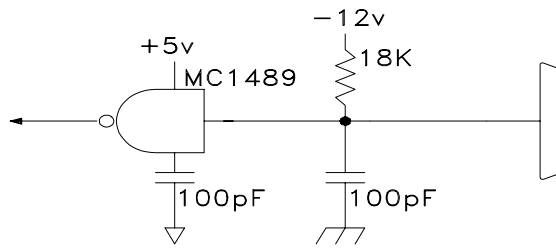
- Use well-shielded and grounded cables.
- Obtain support from your dealer.

Check the troubleshooting chart in this operator's guide, under "Communications" for additional assistance.

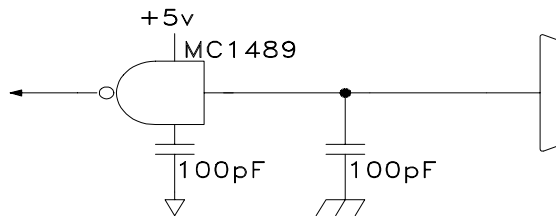
If the printer does not respond at all to the host:

- Make sure that you have selected "Serial" under "Active Interface" in the configuration menu. [Also, do not forget that the printer's "Serial Options" (protocol, baud, parity, and so on) must match those of the computer.]
- Check that Pin 3, RxD, on the printer is connected to TxD on the computer (Pin 2 on a PC; Pin 3 on a PC/AT). If true, connect DTR, Pin 20, on the PC to DCD, Pin 8, on the PC to initiate transmission.

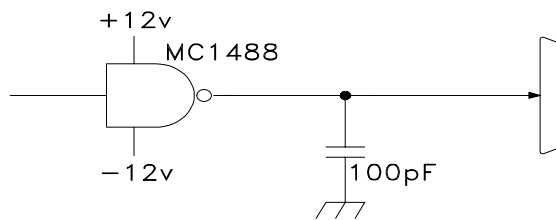
## INTERFACE CIRCUITS



Data Line Receiver



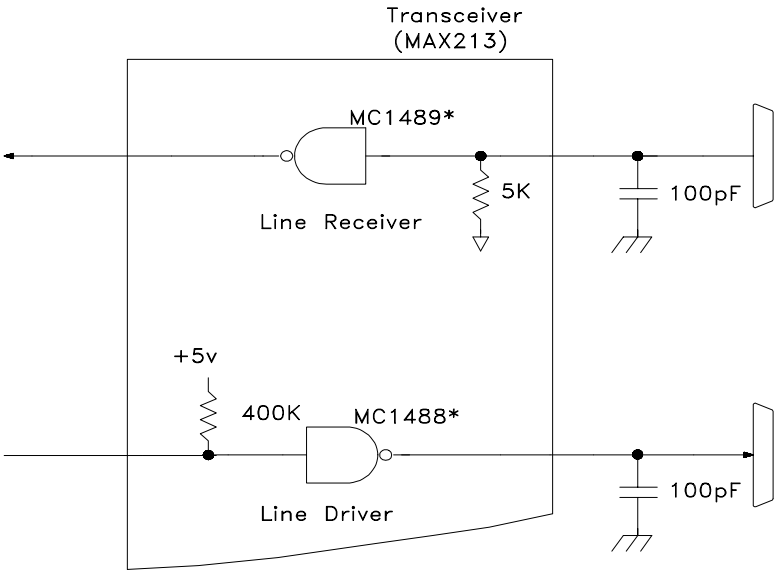
Control Line Receiver



Line Driver

Version 1

JB0-BP1



\* Equivalent Circuits

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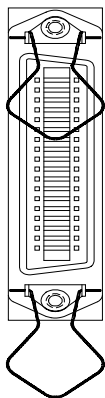
# Appendix C— Parallel Interface

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This appendix deals with Centronics-type parallel interface connectivity.

## PARALLEL INTERFACE BASICS

The parallel interface is Centronics-compatible. It receives parallel data through an 8-bit, input-only port, which is located on the rear panel of the printer. The connector is a 36-pin female Kycon 37-40360-24-BR, or equivalent.



Parallel Port Connector

JB0-BK

## DATA

The host computer sends each data byte to the printer in parallel across Data Lines 1 through 8 (connector Pins 2 through 9). A bit set to logical "1" is transmitted as a high signal; a bit set to logical "0" is transmitted as a low signal.

Input data and all interface control signals are compatible with TTL (Transistor-Transistor Logic) levels, 0 to +5 volts.

## SYNCHRONIZATION

Synchronization is accomplished by externally supplied STROBE\* pulses. The port receives data prior to the leading (negative) edge of STROBE\*.

## HANDSHAKING

Handshaking is accomplished by ACKNLG\* (acknowledge) and BUSY signals. These signals control data flow across the parallel interface.

The computer monitors the state of BUSY to determine if the printer is ready to accept a character. If BUSY is not asserted, the computer sends a character to the interface on DATA 1 through DATA 8.

After the data setup time, the computer asserts STROBE\*. As each character is received, the leading (negative) edge of STROBE\* clocks the BUSY flipflop, which resets it. This asserts the BUSY signal and latches the received character into the parallel port register.

When the printer has processed the character and is ready for another, it sets the BUSY flipflop. This negates the BUSY signal and produces a 5 m s ACKNLG\* pulse. The interface is ready to accept another character as soon as the ACKNLG\* pulse begins.

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\* The asterisks following a signal name signifies that logic 1 is an active low.



## PARALLEL INTERFACE PIN-OUTS FOR PRINTER

The table that follows summarizes the pin assignments on the printer end of the parallel interface. The direction of the arrow indicates whether the signal is an input (←) to the printer or output (→) from the printer.

A twisted pair cable is often used for each signal in the interface, and the connection must be completed on the signal return side. To prevent noise, use cables that are shielded and connect the shield to both the computer and printer chassis.

Using fewer connections than shown in the table may prevent the computer from controlling some printer functions. 36-wire cables are recommended.

Signal Pin #	and Direction	Signal Name	Description
1	←	<b>STROBE</b>	Synchronous input signal for strobing data into the printer. Normally high. Pulse width minimum is 1 ms.
2	←	<b>DATA 1</b>	These 8 signals represent the 8-bit data byte. All eight bits of each character are transmitted to the printer simultaneously. A high level represents a binary "1" digit; a low level represents a binary "0" digit. Data pulse width minimum is 3 ms. Data lines must be asserted before the strobe goes low.
3	←	<b>DATA 2</b>	
4	←	<b>DATA 3</b>	
5	←	<b>DATA 4</b>	
6	←	<b>DATA 5</b>	
7	←	<b>DATA 6</b>	
8	←	<b>DATA 7</b>	
9	←	<b>DATA 8</b>	
10	→	<b>ACKNLG*</b>	The printer sends this pulse to the computer after each character is received. ACKNLG* may be referred to as a "data request pulse," indicating that data were received, and the printer is ready to accept more. ACKNLG* is set high until it receives a character, then goes low with a pulse width of 5 ms. This signal works together with the BUSY signal.
11	→	<b>BUSY</b>	When high, data transfer from the computer to the printer is prevented. BUSY is set high when a character is strobed into the parallel port, and set low when a byte has been read. This signal works together with the ACKNLG* signal.
12	→	<b>PAPER OUT</b>	A high signal indicates the printer is out of paper. The signal comes directly from the printer's paper out switch through a buffer. The buffer also drives the <b>PAPER</b> indicator on the switch panel.

Parallel Interface Pin Assignments

Signal Pin # and Direction	Signal Name	Description
13 →	<b>ON LINE</b>	When high, this signal indicates the printer is on line and ready to accept data (if not busy).
14	<b>0V</b>	Logic GROUND level.
15	<b>NC</b>	Not used.
16	<b>0V</b>	Logic GROUND level.
17	<b>CHASSIS GND</b>	Must be connected to computer chassis to ensure proper printer operation. Connect to printer chassis, not to signal ground.
18 →	<b>+5 VOLTS</b>	Supplies power for external devices. The current is limited to $\frac{3}{4}$ a. to prevent heavy loads on the power supply. Some computers provide +5 v on this pin. This may cause the printer to appear "on" after the power switch has been turned off. The indicator lights remain lit, but the printer beeps if printing is attempted. In this case, you should open Pin 18 in the cable.
19	<b>STROBE* RET</b>	Pins 19 through 30 are GROUND level returns for Pins 1 through 12.
20	<b>DATA 1 RET</b>	
21	<b>DATA 2 RET</b>	
22	<b>DATA 3 RET</b>	
23	<b>DATA 4 RET</b>	
24	<b>DATA 5 RET</b>	
25	<b>DATA 6 RET</b>	

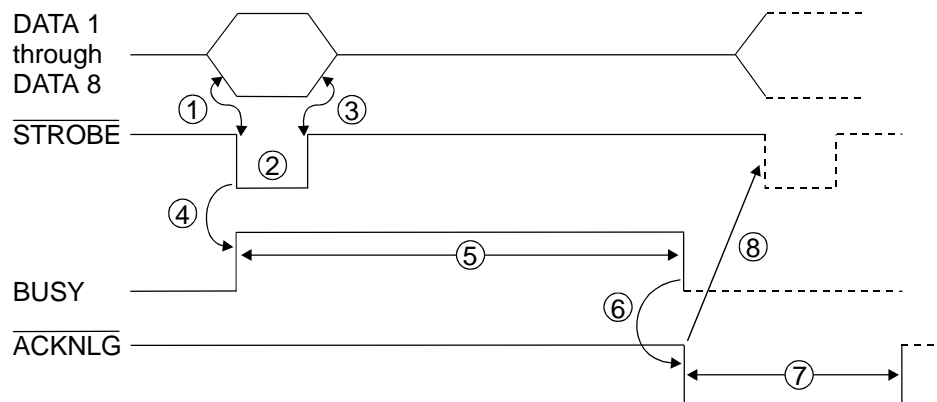
Parallel Interface Pin Assignments, continued

Signal Pin # and Direction	Signal Name	Description
26	<b>DATA 7 RET</b>	
27	<b>DATA 8 RET</b>	
28	<b>ACKNLG* RET</b>	
29	<b>BUSY RET</b>	
30	<b>PAPER OUT RET</b>	
31     ←	<b>INIT*</b>	A low pulse of at least 100 ms (low sensitivity) or 1.66 ms (high sensitivity) resets the printer to its initial power-on state and clears the buffer.
32     →	<b>+5V</b>	Signal is normally high.
33	<b>GND</b>	
34	<b>NC</b>	No connections.
35	<b>NC</b>	No connections.
36	<b>NC</b>	No connections.

Parallel Interface Pin Assignments, continued

## PARALLEL INTERFACE TIMING

The illustration that follows shows the sequence for parallel data transmission.

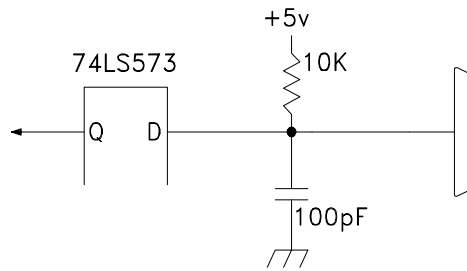


Parallel Interface Timing

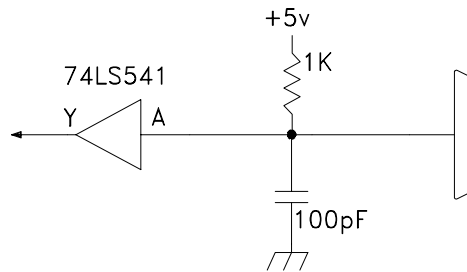
AB0-AR

1. Data set-up time (1  $\mu$ s, minimum)
2. STROBE\* pulse width (1  $\mu$ s, minimum)
3. Data hold time (1  $\mu$ s, minimum)
4. STROBE\* to BUSY delay (100 ns, typical)
5. BUSY length (variable; 35  $\mu$ s, typical)
6. BUSY negation to ACKNLG\* delay (100 ns, typical)
7. ACKNLG\* pulse width (5  $\mu$ s)
8. ACKNLG\* assertion to STROBE\* delay (2  $\mu$ s, minimum)

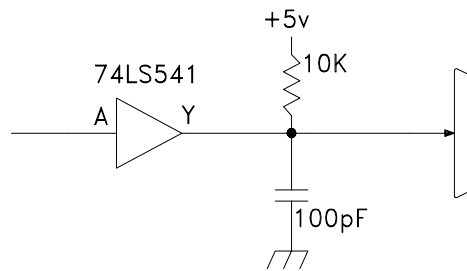
## INTERFACE CIRCUITS



Data Line Receivers



Control Line Receivers



Control Line Drivers

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# Appendix D— Character Sets

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This appendix is concerned primarily with standard character sets created using "Character Options" in the configuration menu.

Character sets determine what the printer does when you send a data byte to the printer.

There are only two categories of doable possibilities. The printer can either print a character (A B C a b c \* ? 1 2 3 etc.) or perform a basic operation (form feed, beep, escape, etc.)

- If your computer and printer are set up to transmit and receive only 7 bits of serial or parallel data per byte, then your printer can do 128 characters and single-code operations.
- If your computer and printer are set up to transmit and receive 8 bits of data per byte (and most are), then your printer can do 256 characters and single-code operations.

The basic single-code operations are standard throughout the printer industry. The groupings of basic operations for character sets are called control code maps. (One common control code map is the ASCII\* control code map.) There are slightly over 40 control code possibilities, of which a maximum of 32 or 33 control codes are ever assigned at any one time to a character set. For a 7-bit data byte, that leaves about "128 - 32 = 96" codes for characters.

The printer can print 428 different characters contained in a built-in ROM character library.

Most printers, including this one, use groupings of these ROM-based characters called character maps. The character maps make assignment of characters from the character library to the character set easier and more standardized between printers. One or more character maps can be assigned to make up the completed character set. An example of a standard character map is the 96-character ASCII map.

The standard ASCII character set, with control and character code assignments, is shown on Pages D-6 and D-7. Most character and control code mappings are variations of this standard character set for a 7-bit code. The ASCII character set covers the standard American computer keyboard.

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\* American Standard Code for Information Interchange



*Note:* Notice that the right and left halves of the ASCII character set are identical. That is because the ASCII set was created for a 7-bit data byte (0000000 to 1111111 in the binary numbering system, or 0 to 127 in decimal, or 00 to 7F in hexadecimal) back in the days of the teletypewriter. Because computers and printers now commonly use an 8-bit data byte (00000000-11111111 binary, 0-255 decimal, or 00-FF hexadecimal), the ASCII character and control codes are repeated on the upper half of the character set to cover the possibilities of the 8th bit being either a binary 0 or a binary 1.

The printer contains literally hundreds of "standard" character and control code map combinations. You can also modify the standard character set using one or more overlays. An overlay can be used to map over some or all of the character and control possibilities with other characters from ROM or RAM character libraries.

This process of creating and modifying characters sets is shown graphically on Page D-8.

## TERMINOLOGY

Terminology used to describe character sets varies widely between IBM, Epson, and DEC. Terminology used in this manual is internally consistent and follows standard usage where possible. The terminology used to describe character sets is defined below:

**Character.** A printable pattern composed of dots. Letters, numbers, punctuation marks, graphic shapes, and all other symbols are characters. A blank space is also a valid character.

**Character Library.** A defined group of printable characters stored in the printer. The printer contains one main, ROM-based character library when shipped from the factory.

**Character Source.** The location of character libraries: ROM or RAM.

**Control Code.** A single byte of information that starts, stops, or modifies printer action.

**Mapping.** Process of assigning characters and control codes to data bytes.

**Character Set.** A complete assignment of control codes and printable characters for all data bytes.

**Code Page.** A predefined IBM character map.

**Character Map.** An assignment of printable characters used in creating a character set.

**Control Code Map.** An assignment of control codes used in creating a character set.

## THE MAIN CHARACTER LIBRARY

Pages D-9 and D-10 show all of the printer's printable draft and NLQ characters. These constitute the main character library.

When you select a character map in the configuration menu, the printer chooses the characters from this built-in ROM library of characters and lists the character numbers in the data byte map.

You can print the data byte map from the configuration menu.

Part of a sample data byte printout is shown on Page 63. Notice the "a" character in the data byte map. The CHAR NUM for "a" is 097 which is assigned as DATA BYTE 097 from the character library on Page D-9. The hexadecimal character number, equivalent to 097 decimal, is 061h, which is the character shown in the Standard ASCII Character Set (Column "6-", Row "-1") on Page D-6.

You can remap characters from the main character library into the active character set. You might wish to do this if you need, for example, a registered mark (®) which is CHAR NUM 276 (114h) in place of the # symbol in Column "2-", Row "-3" of the character set. You would make such a substitution using a universal control command.

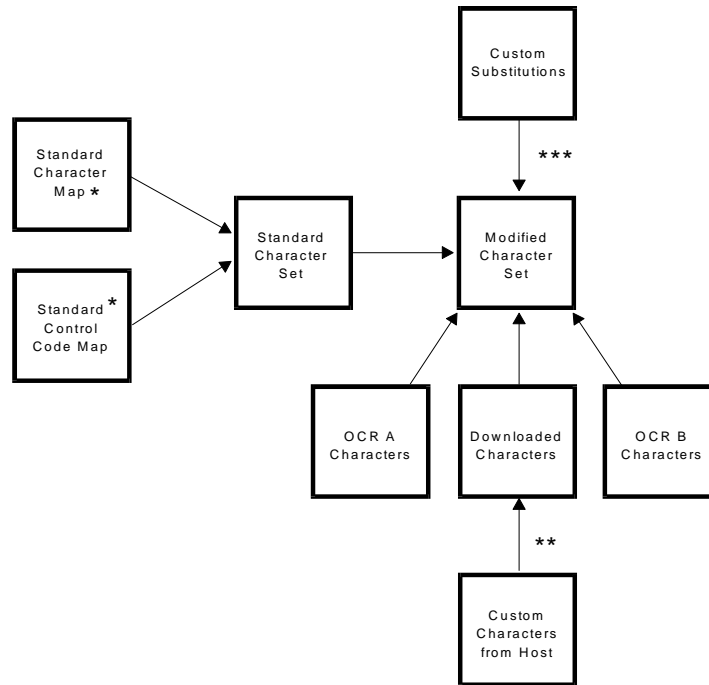
**STANDARD ASCII CHARACTER SET\***

	0-	1-	2-	3-	4-	5-	6-	7-
0	<b>NUL</b> 0	<b>DLE</b> 16	<b>SP</b> 32	<b>0</b> 48	<b>@</b> 64	<b>P</b> 80	<b>`</b> 96	<b>p</b> 112
-1	<b>SOH</b> 1	<b>DC1</b> 17	<b>!</b> 33	<b>1</b> 49	<b>A</b> 65	<b>Q</b> 81	<b>a</b> 97	<b>q</b> 113
-2	<b>STX</b> 2	<b>DC2</b> 18	<b>"</b> 34	<b>2</b> 50	<b>B</b> 66	<b>R</b> 82	<b>b</b> 98	<b>r</b> 114
-3	<b>ETX</b> 3	<b>DC3</b> 19	<b>#</b> 35	<b>3</b> 51	<b>C</b> 67	<b>S</b> 83	<b>c</b> 99	<b>s</b> 115
-4	<b>EOT</b> 4	<b>DC4</b> 20	<b>\$</b> 36	<b>4</b> 52	<b>D</b> 68	<b>T</b> 84	<b>d</b> 100	<b>t</b> 116
-5	<b>ENQ</b> 5	<b>NAK</b> 21	<b>%</b> 37	<b>5</b> 53	<b>E</b> 69	<b>U</b> 85	<b>e</b> 101	<b>u</b> 117
-6	<b>ACK</b> 6	<b>SYN</b> 22	<b>&amp;</b> 38	<b>6</b> 54	<b>F</b> 70	<b>V</b> 86	<b>f</b> 102	<b>v</b> 118
-7	<b>BEL</b> 7	<b>ETB</b> 23	<b>'</b> 39	<b>7</b> 55	<b>G</b> 71	<b>W</b> 87	<b>g</b> 103	<b>w</b> 119
-8	<b>BS</b> 8	<b>CAN</b> 24	<b>(</b> 40	<b>8</b> 56	<b>H</b> 72	<b>X</b> 88	<b>h</b> 104	<b>x</b> 120
-9	<b>HT</b> 9	<b>EM</b> 25	<b>)</b> 41	<b>9</b> 57	<b>I</b> 73	<b>Y</b> 89	<b>i</b> 105	<b>y</b> 121
-A	<b>LF</b> 10	<b>SUB</b> 26	<b>*</b> 42	<b>:</b> 58	<b>J</b> 74	<b>Z</b> 90	<b>j</b> 106	<b>z</b> 122
-B	<b>VT</b> 11	<b>ESC</b> 27	<b>+</b> 43	<b>;</b> 59	<b>K</b> 75	<b>[</b> 91	<b>k</b> 107	<b>{</b> 123
-C	<b>FF</b> 12	<b>FS</b> 28	<b>,</b> 44	<b>&lt;</b> 60	<b>L</b> 76	<b>\</b> 92	<b>l</b> 108	<b> </b> 124
-D	<b>CR</b> 13	<b>GS</b> 29	<b>-</b> 45	<b>=</b> 61	<b>M</b> 77	<b>]</b> 93	<b>m</b> 109	<b>}</b> 125
-E	<b>SO</b> 14	<b>RS</b> 30	<b>.</b> 46	<b>&gt;</b> 62	<b>N</b> 78	<b>^</b> 94	<b>n</b> 110	<b>~</b> 126
-F	<b>SI</b> 15	<b>US</b> 31	<b>/</b> 47	<b>?</b> 63	<b>O</b> 79	<b>_</b> 95	<b>o</b> 111	<b>DEL</b> 127

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\* Standard ASCII Control Code Map is shaded; Standard ASCII Character Code Map is unshaded.

8-	9-	A-	B-	C-	D-	E-	F-	
<b>NUL</b> 128	<b>DLE</b> 144	<b>SP</b> 160	<b>0</b> 176	<b>@</b> 192	<b>P</b> 208	<b>`</b> 224	<b>p</b> 240	<b>0</b>
<b>SOH</b> 129	<b>DC1</b> 145	<b>!</b> 161	<b>1</b> 177	<b>A</b> 193	<b>Q</b> 209	<b>a</b> 225	<b>q</b> 241	<b>-1</b>
<b>STX</b> 130	<b>DC2</b> 146	<b>"</b> 162	<b>2</b> 178	<b>B</b> 194	<b>R</b> 210	<b>b</b> 226	<b>r</b> 242	<b>-2</b>
<b>ETX</b> 131	<b>DC3</b> 147	<b>#</b> 163	<b>3</b> 179	<b>C</b> 195	<b>S</b> 211	<b>c</b> 227	<b>s</b> 243	<b>-3</b>
<b>EOT</b> 132	<b>DC4</b> 148	<b>\$</b> 164	<b>4</b> 180	<b>D</b> 196	<b>T</b> 212	<b>d</b> 228	<b>t</b> 244	<b>-4</b>
<b>ENQ</b> 133	<b>NAK</b> 149	<b>%</b> 165	<b>5</b> 181	<b>E</b> 197	<b>U</b> 213	<b>e</b> 229	<b>u</b> 245	<b>-5</b>
<b>ACK</b> 134	<b>SYN</b> 150	<b>&amp;</b> 166	<b>6</b> 182	<b>F</b> 198	<b>V</b> 214	<b>f</b> 230	<b>v</b> 246	<b>-6</b>
<b>BEL</b> 135	<b>ETB</b> 151	<b>'</b> 167	<b>7</b> 183	<b>G</b> 199	<b>W</b> 215	<b>g</b> 231	<b>w</b> 247	<b>-7</b>
<b>BS</b> 136	<b>CAN</b> 152	<b>(</b> 168	<b>8</b> 184	<b>H</b> 200	<b>X</b> 216	<b>h</b> 232	<b>x</b> 248	<b>-8</b>
<b>HT</b> 137	<b>EM</b> 153	<b>)</b> 169	<b>9</b> 185	<b>I</b> 201	<b>Y</b> 217	<b>i</b> 233	<b>y</b> 249	<b>-9</b>
<b>LF</b> 138	<b>SUB</b> 154	<b>*</b> 170	<b>:</b> 186	<b>J</b> 202	<b>Z</b> 218	<b>j</b> 234	<b>z</b> 250	<b>-A</b>
<b>VT</b> 139	<b>ESC</b> 155	<b>+</b> 171	<b>;</b> 187	<b>K</b> 203	<b>[</b> 219	<b>k</b> 235	<b>{</b> 251	<b>-B</b>
<b>FF</b> 140	<b>FS</b> 156	<b>,</b> 172	<b>&lt;</b> 188	<b>L</b> 204	<b>\</b> 220	<b>l</b> 236	<b> </b> 252	<b>-C</b>
<b>CR</b> 141	<b>GS</b> 157	<b>-</b> 173	<b>=</b> 189	<b>M</b> 205	<b>]</b> 221	<b>m</b> 237	<b>}</b> 253	<b>-D</b>
<b>SO</b> 142	<b>RS</b> 158	<b>.</b> 174	<b>&gt;</b> 190	<b>N</b> 206	<b>^</b> 222	<b>n</b> 238	<b>~</b> 254	<b>-E</b>
<b>SI</b> 143	<b>US</b> 159	<b>/</b> 175	<b>?</b> 191	<b>O</b> 207	<b>_</b> 223	<b>o</b> 239	<b>DEL</b> 255	<b>-F</b>



JB0-BF

*Note:* Except for custom substitutions from the ROM character library, all mapping is done using either "Character Options" in the configuration menu or control commands. Custom substitutions from the ROM character library can only be done using universal control commands.

\* Emulation dependent.

\*\* Custom characters from the host are downloaded using universal control commands.

\*\*\* Custom substitutions from the ROM library are done using universal control commands.

## Process of Creating Character Sets

0 -> 15	000h -> 00Fh	00000000000000000000000000000000
16 -> 31	010h -> 01Fh	><0!11111111111111111111111111111111
32 -> 47	020h -> 02Fh	!"#\$%&'()*+,-./
48 -> 63	030h -> 03Fh	0123456789:;<=>?
64 -> 79	040h -> 04Fh	@ABCDEFGHIJKLMNO
80 -> 95	050h -> 05Fh	PQRSTUVWXYZ[\]^_`
96 -> 111	060h -> 06Fh	abcdefghijklmnopqrstuvwxyz
112 -> 127	070h -> 07Fh	07Fh
128 -> 143	080h -> 08Fh	08Fh
144 -> 159	090h -> 09Fh	09Fh
160 -> 175	0A0h -> 0AFh	0AFh
176 -> 191	0B0h -> 0BFh	0BFh
192 -> 207	0C0h -> 0CFh	0CFh
208 -> 223	0D0h -> 0DFh	0DFh
224 -> 239	0E0h -> 0EFh	0EFh
240 -> 255	0F0h -> 0FFh	0FFh
256 -> 271	100h -> 10Fh	10Fh
272 -> 287	110h -> 11Fh	11Fh
288 -> 303	120h -> 12Fh	12Fh
304 -> 319	130h -> 13Fh	13Fh
320 -> 335	140h -> 14Fh	14Fh
336 -> 351	150h -> 15Fh	15Fh
352 -> 367	160h -> 16Fh	16Fh
368 -> 383	170h -> 17Fh	17Fh
384 -> 399	180h -> 18Fh	18Fh
400 -> 415	190h -> 19Fh	19Fh
416 -> 431	1A0h -> 1AFh	1AFh
432 -> 447	1B0h -> 1BFh	1BFh

0 → 15	000h → 00Fh	00000000000000000000000000000000
16 → 31	010h → 01Fh	00000000000000000000000000000000
32 → 47	020h → 02Fh	00000000000000000000000000000000
48 → 63	030h → 03Fh	00000000000000000000000000000000
64 → 79	040h → 04Fh	00000000000000000000000000000000
80 → 95	050h → 05Fh	00000000000000000000000000000000
96 → 111	060h → 06Fh	00000000000000000000000000000000
112 → 127	070h → 07Fh	00000000000000000000000000000000
128 → 143	080h → 08Fh	00000000000000000000000000000000
144 → 159	090h → 09Fh	00000000000000000000000000000000
160 → 175	0A0h → 0AFh	00000000000000000000000000000000
176 → 191	0B0h → 0BFh	00000000000000000000000000000000
192 → 207	0C0h → 0CFh	00000000000000000000000000000000
208 → 223	0D0h → 0DFh	00000000000000000000000000000000
224 → 239	0E0h → 0EFh	00000000000000000000000000000000
240 → 255	0F0h → 0FFh	00000000000000000000000000000000
256 → 271	100h → 10Fh	00000000000000000000000000000000
272 → 287	110h → 11Fh	00000000000000000000000000000000
288 → 303	120h → 12Fh	00000000000000000000000000000000
304 → 319	130h → 13Fh	00000000000000000000000000000000
320 → 335	140h → 14Fh	00000000000000000000000000000000
336 → 351	150h → 15Fh	00000000000000000000000000000000
352 → 367	160h → 16Fh	00000000000000000000000000000000
368 → 383	170h → 17Fh	00000000000000000000000000000000
384 → 399	180h → 18Fh	00000000000000000000000000000000
400 → 415	190h → 19Fh	00000000000000000000000000000000
416 → 431	1A0h → 1AFh	00000000000000000000000000000000
432 → 442	1B0h → 1BAh	00000000000000000000000000000000



## THE CONTROL CODE MAP

Speaking in graphic terms, the first two columns in most character sets, such as the one shown on Page D-6, contain control codes. Below is an alphabetical list of abbreviations used in character sets in this appendix and in the CTRL CODE column of the data byte map.

Pages D-12 through D-15 show all possible emulation-dependent control code maps. You select the control code map using either "Character Options" in the configuration menu or emulation control commands.

NUL Null (No Operation)	SYN Synchronous Idle
SOH Start of Header	ETB End of Transmission Block
STX Start of Text	CAN Cancel
ETX End of Text	EM End of Medium
EOT End of Transmission	SUB Substitute
ENQ Enquiry	ESC Escape
ACK Acknowledge	FS Field Separator
BEL Bell	GS Group Separator
BS Back Space	RS Record Separator
HT Horizontal Tab	US Unit Separator
LF Line Feed	IND Index
VT Vertical Tab	NEL Next Line
FF Form Feed	HTS Horizontal Tabulation Set
CR Carriage Return	VTB Vertical Tab Set
SO Shift Out	PLD Partial Line Down
SI Shift In	SS2 Single Shift 2
DLE Data Link Escape	SS3 Single Shift 3
DC1 Device Control 1 (X-ON)	DCS Device Control String
DC2 Device Control 2	CSI Control Sequence Introducer
DC3 Device Control 3 (X-OFF)	ST String Terminator*
DC4 Device Control 4	DEL Delete (Rub Out)
NAK Negative Acknowledge	

In the control code maps that follow, the number below the control code abbreviations is the decimal equivalent of the hexadecimal column-row value.

---

\* Technically, not actually a control code.

## EPSON CONTROL CODE MAP

	0-/8-	1-/9-
0	<b>NUL</b> 0	16
-1	<b>SOH</b> 1	<b>DC1</b> 17
-2	2	<b>DC2</b> 18
-3	3	<b>DC3</b> 19
-4	4	<b>DC4</b> 20
-5	5	21
-6	6	22
-7	<b>BEL</b> 7	23
-8	<b>BS</b> 8	<b>CAN</b> 24
-9	<b>HT</b> 9	25
-A	<b>LF</b> 10	26
-B	<b>VT</b> 11	<b>ESC</b> 27
-C	<b>FF</b> 12	28
-D	<b>CR</b> 13	29
-E	<b>SO</b> 14	30
-F	<b>SI</b> 15	31

Control Code Map for Epson Character Set\*

---

\* Characters can be mapped to unshaded areas.

## IBM CONTROL CODE MAPS

	0-/8-	1-/9-
0	<b>NUL</b> 0/128	16/144
-1	<b>SOH</b> 1/129	<b>DC1</b> 17/145
-2	2/130	<b>DC2</b> 18/146
-3	3/131	<b>DC3</b> 19/147
-4	4/132	<b>DC4</b> 20/148
-5	5/133	21/149
-6	6/134	22/150
-7	<b>BEL</b> 7/135	23/151
-8	<b>BS</b> 8/136	<b>CAN</b> 24/152
-9	<b>HT</b> 9/137	25/153
-A	<b>LF</b> 10/138	26/154
-B	<b>VT</b> 11/139	<b>ESC</b> 27/155
-C	<b>FF</b> 12/140	28/156
-D	<b>CR</b> 13/141	29/157
-E	<b>SO</b> 14/142	30/158
-F	<b>SI</b> 15/143	31/159

Control Code  
Map for Lower  
and Upper Halves  
of IBM #1  
Character Sets

	0-	1-
0	<b>NUL</b> 0	16
-1	<b>SOH</b> 1	<b>DC1</b> 17
-2	2	<b>DC2</b> 18
-3	3	<b>DC3</b> 19
-4	4	<b>DC4</b> 20
-5	5	21
-6	6	22
-7	<b>BEL</b> 7	23
-8	<b>BS</b> 8	<b>CAN</b> 24
-9	<b>HT</b> 9	25
-A	<b>LF</b> 10	26
-B	<b>VT</b> 11	<b>ESC</b> 27
-C	<b>FF</b> 12	28
-D	<b>CR</b> 13	29
-E	<b>SO</b> 14	30
-F	<b>SI</b> 15	31

Control Code  
Map for Lower  
Half of IBM #2  
Character Sets\*

---

\* Characters can be mapped to unshaded areas.

**DEC 7-BIT C0 CONTROL CODE MAP**

	<b>0-8-</b>	<b>1-9-</b>
<b>0</b>	<b>NUL</b> 0/128	16/144
<b>-1</b>	<b>SOH</b> 1/129	<b>DC1</b> 17/145
<b>-2</b>	2/130	18/146
<b>-3</b>	3/131	<b>DC3</b> 19/147
<b>-4</b>	4/132	20/148
<b>-5</b>	<b>ENQ</b> 5/133	21/149
<b>-6</b>	6/134	22/150
<b>-7</b>	<b>BEL</b> 7/135	23/151
<b>-8</b>	<b>BS</b> 8/136	<b>CAN</b> 24/152
<b>-9</b>	<b>HT</b> 9/137	25/153
<b>-A</b>	<b>LF</b> 10/138	26/154
<b>-B</b>	<b>VT</b> 11/139	<b>ESC</b> 27/155
<b>-C</b>	<b>FF</b> 12/140	28/156
<b>-D</b>	<b>CR</b> 13/141	29/157
<b>-E</b>	<b>SO</b> 14/142	30/158
<b>-F</b>	<b>SI</b> 15/143	31/159

## DEC 8-BIT CONTROL CODE MAPS

	0-	1-
0	<b>NUL</b> 0	16
-1	<b>SOH</b> 1	<b>DC1</b> 17
-2	2	18
-3	3	<b>DC3</b> 19
-4	4	20
-5	<b>ENQ</b> 5	21
-6	6	22
-7	<b>BEL</b> 7	23
-8	<b>BS</b> 8	<b>CAN</b> 24
-9	<b>HT</b> 9	25
-A	<b>LF</b> 10	26
-B	<b>VT</b> 11	<b>ESC</b> 27
-C	<b>FF</b> 12	28
-D	<b>CR</b> 13	29
-E	<b>SO</b> 14	30
-F	<b>SI</b> 15	31

C0 Control Code

Map for Lower  
Half of DEC  
8-Bit Character  
Set

	8-	9-
0	<b>NUL</b> 128	<b>DCS</b> 144
-1	129	145
-2	130	146
-3	131	147
-4	<b>IND</b> 132	148
-5	<b>NEL</b> 133	149
-6	134	150
-7	135	151
-8	<b>HTS</b> 136	152
-9	137	153
-A	<b>VTS</b> 138	154
-B	<b>PLD</b> 139	<b>CSI</b> 155
-C	140	<b>ST</b> 156
-D	141	157
-E	<b>SS2</b> 142	158
-F	<b>SS3</b> 143	159

C1 Control  
Code  
Map for Upper  
Half of DEC  
8-Bit Character  
Set

## THE CHARACTER MAP

All of the popular character maps can be selected from the configuration menu under "Character Options." You can select these same character maps using control commands.

There are two types of configuration menu character maps:

- Emulation-dependent character maps that are, more or less, complete collections of characters.
- Emulation-independent character maps that are partial assortments of special characters, such as the OCR A and OCR B overlays.

You can select one of the OCR overlays under "Overlay Characters" in the "Character Options" portion of the configuration menu. The overlay characters replace the characters that were mapped-in from the emulation-dependent character map.

The configuration menu character maps are listed and illustrated on the following pages.

<b>Configuration Menu Character Maps</b>	<b>Page</b>
<b>Emulation Dependent Character Maps</b>	
Epson National-Use	D-18
Epson Hebrew	D-20
IBM Code Page 437 (U.S.)	D-22
IBM #2 Code Page 437 (Hebrew)	D-24
IBM Code Page 850 (Multilingual)	D-26
IBM Code Page 860 (Portugal)	D-28
DEC National-Use	D-30
DEC Multilingual	D-31
DEC Hebrew	D-32
DEC VT100 Line Draw	D-33
<b>Overlays</b>	
OCR A	D-34
OCR B	D-35

# EPSON NATIONAL-USE CHARACTER MAP\*

	0-	1-	2-	3-	4-	5-	6-	7-
0			<b>SP</b> 32	<b>0</b> 48	<b>@</b> 64	<b>P</b> 80	<b>`</b> 96	<b>p</b> 112
-1			<b>!</b> 33	<b>1</b> 49	<b>A</b> 65	<b>Q</b> 81	<b>a</b> 97	<b>q</b> 113
-2			<b>"</b> 34	<b>2</b> 50	<b>B</b> 66	<b>R</b> 82	<b>b</b> 98	<b>r</b> 114
-3			<b>#</b> 35	<b>3</b> 51	<b>C</b> 67	<b>S</b> 83	<b>c</b> 99	<b>s</b> 115
-4			<b>\$</b> 36	<b>4</b> 52	<b>D</b> 68	<b>T</b> 84	<b>d</b> 100	<b>t</b> 116
-5			<b>%</b> 37	<b>5</b> 53	<b>E</b> 69	<b>U</b> 85	<b>e</b> 101	<b>u</b> 117
-6			<b>&amp;</b> 38	<b>6</b> 54	<b>F</b> 70	<b>V</b> 86	<b>f</b> 102	<b>v</b> 118
-7			<b>'</b> 39	<b>7</b> 55	<b>G</b> 71	<b>W</b> 87	<b>g</b> 103	<b>w</b> 119
-8			<b>(</b> 40	<b>8</b> 56	<b>H</b> 72	<b>X</b> 88	<b>h</b> 104	<b>x</b> 120
-9			<b>)</b> 41	<b>9</b> 57	<b>I</b> 73	<b>Y</b> 89	<b>i</b> 105	<b>y</b> 121
-A			<b>*</b> 42	<b>:</b> 58	<b>J</b> 74	<b>Z</b> 90	<b>j</b> 106	<b>z</b> 122
-B			<b>+</b> 43	<b>;</b> 59	<b>K</b> 75	<b>[</b> 91	<b>k</b> 107	<b>{</b> 123
-C			<b>,</b> 44	<b>&lt;</b> 60	<b>L</b> 76	<b>\</b> 92	<b>l</b> 108	<b> </b> 124
-D			<b>-</b> 45	<b>=</b> 61	<b>M</b> 77	<b>]</b> 93	<b>m</b> 109	<b>}</b> 125
-E			<b>.</b> 46	<b>&gt;</b> 62	<b>N</b> 78	<b>^</b> 94	<b>n</b> 110	<b>~</b> 126
-F			<b>/</b> 47	<b>?</b> 63	<b>O</b> 79	<b>_</b> 95	<b>o</b> 111	<b>DEL</b> 127

\* Shown with 12 double-boxed U.S. character substitutions. See Page D-36 for other character substitutions.



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9-

A-	B-	C-	D-	E-	F-	
<b>SP</b> 160	<b>0</b> 176	<b>@</b> 192	<b>P</b> 208	<b>`</b> 224	<b>p</b> 240	<b>0</b>
<b>!</b> 161	<b>1</b> 177	<b>A</b> 193	<b>Q</b> 209	<b>a</b> 225	<b>q</b> 241	<b>-1</b>
<b>"</b> 162	<b>2</b> 178	<b>B</b> 194	<b>R</b> 210	<b>b</b> 226	<b>r</b> 242	<b>-2</b>
<b>#</b> 163	<b>3</b> 179	<b>C</b> 195	<b>S</b> 211	<b>c</b> 227	<b>s</b> 243	<b>-3</b>
<b>\$</b> 164	<b>4</b> 180	<b>D</b> 196	<b>T</b> 212	<b>d</b> 228	<b>t</b> 244	<b>-4</b>
<b>%</b> 165	<b>5</b> 181	<b>E</b> 197	<b>U</b> 213	<b>e</b> 229	<b>u</b> 245	<b>-5</b>
<b>&amp;</b> 166	<b>6</b> 182	<b>F</b> 198	<b>V</b> 214	<b>f</b> 230	<b>v</b> 246	<b>-6</b>
<b>'</b> 167	<b>7</b> 183	<b>G</b> 199	<b>W</b> 215	<b>g</b> 231	<b>w</b> 247	<b>-7</b>
<b>(</b> 168	<b>8</b> 184	<b>H</b> 200	<b>X</b> 216	<b>h</b> 232	<b>x</b> 248	<b>-8</b>
<b>)</b> 169	<b>9</b> 185	<b>I</b> 201	<b>Y</b> 217	<b>i</b> 233	<b>y</b> 249	<b>-9</b>
<b>*</b> 170	<b>:</b> 186	<b>J</b> 202	<b>Z</b> 218	<b>j</b> 234	<b>z</b> 250	<b>-A</b>
<b>+</b> 171	<b>;</b> 187	<b>K</b> 203	<b>[</b> 219	<b>k</b> 235	<b>{</b> 251	<b>-B</b>
<b>,</b> 172	<b>&lt;</b> 188	<b>L</b> 204	<b>\</b> 220	<b>l</b> 236	<b>/</b> 252	<b>-C</b>
<b>-</b> 173	<b>=</b> 189	<b>M</b> 205	<b>]</b> 221	<b>m</b> 237	<b>}</b> 253	<b>-D</b>
<b>.</b> 174	<b>&gt;</b> 190	<b>N</b> 206	<b>^</b> 222	<b>n</b> 238	<b>~</b> 254	<b>-E</b>
<b>/</b> 175	<b>?</b> 191	<b>O</b> 207	<b>_</b> 223	<b>o</b> 239	<b>DEL</b> 255	<b>-F</b>

## EPSON HEBREW CHARACTER MAP

	0-	1-	2-	3-	4-	5-	6-	7-
<b>0</b>			<b>SP</b> 32	<b>0</b> 48	<b>@</b> 64	<b>P</b> 80	<b>à</b> 96	<b>ø</b> 112
<b>-1</b>			<b>!</b> 33	<b>1</b> 49	<b>A</b> 65	<b>Q</b> 81	<b>á</b> 97	<b>ñ</b> 113
<b>-2</b>			<b>"</b> 34	<b>2</b> 50	<b>B</b> 66	<b>R</b> 82	<b>â</b> 98	<b>ö</b> 114
<b>-3</b>			<b>#</b> 35	<b>3</b> 51	<b>C</b> 67	<b>S</b> 83	<b>ã</b> 99	<b>ó</b> 115
<b>-4</b>			<b>\$</b> 36	<b>4</b> 52	<b>D</b> 68	<b>T</b> 84	<b>ä</b> 100	<b>ô</b> 116
<b>-5</b>			<b>%</b> 37	<b>5</b> 53	<b>E</b> 69	<b>U</b> 85	<b>å</b> 101	<b>õ</b> 117
<b>-6</b>			<b>&amp;</b> 38	<b>6</b> 54	<b>F</b> 70	<b>V</b> 86	<b>æ</b> 102	<b>ö</b> 118
<b>-7</b>			<b>'</b> 39	<b>7</b> 55	<b>G</b> 71	<b>W</b> 87	<b>ç</b> 103	<b>÷</b> 119
<b>-8</b>			<b>(</b> 40	<b>8</b> 56	<b>H</b> 72	<b>X</b> 88	<b>è</b> 104	<b>ø</b> 120
<b>-9</b>			<b>)</b> 41	<b>9</b> 57	<b>I</b> 73	<b>Y</b> 89	<b>é</b> 105	<b>ù</b> 121
<b>-A</b>			<b>*</b> 42	<b>:</b> 58	<b>J</b> 74	<b>Z</b> 90	<b>ê</b> 106	<b>ú</b> 122
<b>-B</b>			<b>+</b> 43	<b>;</b> 59	<b>K</b> 75	<b>[</b> 91	<b>ë</b> 107	<b>{</b> 123
<b>-C</b>			<b>,</b> 44	<b>&lt;</b> 60	<b>L</b> 76	<b>\</b> 92	<b>ì</b> 108	<b>ì</b> 124
<b>-D</b>			<b>-</b> 45	<b>=</b> 61	<b>M</b> 77	<b>]</b> 93	<b>í</b> 109	<b>}</b> 125
<b>-E</b>			<b>.</b> 46	<b>&gt;</b> 62	<b>N</b> 78	<b>^</b> 94	<b>î</b> 110	<b>~</b> 126
<b>-F</b>			<b>/</b> 47	<b>?</b> 63	<b>O</b> 79	<b>_</b> 95	<b>ï</b> 111	<b>DEL</b> 127

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9-

A-	B-	C-	D-	E-	F-	
<b>SP</b> 160	<b>0</b> 176	<b>@</b> 192	<b>P</b> 208	<b>`</b> 224	<b>p</b> 240	<b>0</b>
<b>!</b> 161	<b>1</b> 177	<b>A</b> 193	<b>Q</b> 209	<b>a</b> 225	<b>q</b> 241	<b>-1</b>
<b>"</b> 162	<b>2</b> 178	<b>B</b> 194	<b>R</b> 210	<b>b</b> 226	<b>r</b> 242	<b>-2</b>
<b>#</b> 163	<b>3</b> 179	<b>C</b> 195	<b>S</b> 211	<b>c</b> 227	<b>s</b> 243	<b>-3</b>
<b>\$</b> 164	<b>4</b> 180	<b>D</b> 196	<b>T</b> 212	<b>d</b> 228	<b>t</b> 244	<b>-4</b>
<b>%</b> 165	<b>5</b> 181	<b>E</b> 197	<b>U</b> 213	<b>e</b> 229	<b>u</b> 245	<b>-5</b>
<b>&amp;</b> 166	<b>6</b> 182	<b>F</b> 198	<b>V</b> 214	<b>f</b> 230	<b>v</b> 246	<b>-6</b>
<b>'</b> 167	<b>7</b> 183	<b>G</b> 199	<b>W</b> 215	<b>g</b> 231	<b>w</b> 247	<b>-7</b>
<b>(</b> 168	<b>8</b> 184	<b>H</b> 200	<b>X</b> 216	<b>h</b> 232	<b>x</b> 248	<b>-8</b>
<b>)</b> 169	<b>9</b> 185	<b>I</b> 201	<b>Y</b> 217	<b>i</b> 233	<b>y</b> 249	<b>-9</b>
<b>*</b> 170	<b>:</b> 186	<b>J</b> 202	<b>Z</b> 218	<b>j</b> 234	<b>z</b> 250	<b>-A</b>
<b>+</b> 171	<b>;</b> 187	<b>K</b> 203	<b>[</b> 219	<b>k</b> 235	<b>{</b> 251	<b>-B</b>
<b>,</b> 172	<b>&lt;</b> 188	<b>L</b> 204	<b>\</b> 220	<b>l</b> 236	<b>!</b> 252	<b>-C</b>
<b>-</b> 173	<b>=</b> 189	<b>M</b> 205	<b>]</b> 221	<b>m</b> 237	<b>}</b> 253	<b>-D</b>
<b>.</b> 174	<b>&gt;</b> 190	<b>N</b> 206	<b>^</b> 222	<b>n</b> 238	<b>~</b> 254	<b>-E</b>
<b>/</b> 175	<b>?</b> 191	<b>O</b> 207	<b>_</b> 223	<b>o</b> 239	<b>DEL</b> 255	<b>-F</b>

**IBM CODE PAGE 437 (U.S.)**

	0-*	1-*	2-	3-	4-	5-	6-	7-
0			<b>SP</b> 32	<b>0</b> 48	<b>@</b> 64	<b>P</b> 80	<b>`</b> 96	<b>p</b> 112
-1			<b>!</b> 33	<b>1</b> 49	<b>A</b> 65	<b>Q</b> 81	<b>a</b> 97	<b>q</b> 113
-2			<b>"</b> 34	<b>2</b> 50	<b>B</b> 66	<b>R</b> 82	<b>b</b> 98	<b>r</b> 114
-3	<b>♥</b> 3		<b>#</b> 35	<b>3</b> 51	<b>C</b> 67	<b>S</b> 83	<b>c</b> 99	<b>s</b> 115
-4	<b>♦</b> 4		<b>\$</b> 36	<b>4</b> 52	<b>D</b> 68	<b>T</b> 84	<b>d</b> 100	<b>t</b> 116
-5	<b>♣</b> 5	<b>§</b> 21	<b>%</b> 37	<b>5</b> 53	<b>E</b> 69	<b>U</b> 85	<b>e</b> 101	<b>u</b> 117
-6	<b>♠</b> 6		<b>&amp;</b> 38	<b>6</b> 54	<b>F</b> 70	<b>V</b> 86	<b>f</b> 102	<b>v</b> 118
-7			<b>'</b> 39	<b>7</b> 55	<b>G</b> 71	<b>W</b> 87	<b>g</b> 103	<b>w</b> 119
-8			<b>(</b> 40	<b>8</b> 56	<b>H</b> 72	<b>X</b> 88	<b>h</b> 104	<b>x</b> 120
-9			<b>)</b> 41	<b>9</b> 57	<b>I</b> 73	<b>Y</b> 89	<b>i</b> 105	<b>y</b> 121
-A			<b>*</b> 42	<b>:</b> 58	<b>J</b> 74	<b>Z</b> 90	<b>j</b> 106	<b>z</b> 122
-B			<b>+</b> 43	<b>;</b> 59	<b>K</b> 75	<b>[</b> 91	<b>k</b> 107	<b>{</b> 123
-C			<b>,</b> 44	<b>&lt;</b> 60	<b>L</b> 76	<b>\</b> 92	<b>l</b> 108	<b>!</b> 124
-D			<b>-</b> 45	<b>=</b> 61	<b>M</b> 77	<b>]</b> 93	<b>m</b> 109	<b>}</b> 125
-E			<b>.</b> 46	<b>&gt;</b> 62	<b>N</b> 78	<b>^</b> 94	<b>n</b> 110	<b>~</b> 126
-F			<b>/</b> 47	<b>?</b> 63	<b>O</b> 79	<b>_</b> 95	<b>o</b> 111	<b></b> 127

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\* Mappings of printable characters in Columns 0 and 1 only apply when using IBM #2 control codes.

8-*	9-*	A-	B-	C-	D-	E-	F-	
Ç 128	É 144	á 160	• 176	• 192	• 208	• 224	• 240	0
ü 129	Æ 145	í 161	• 177	• 193	• 209	ß 225	± 241	-1
é 130	Æ 146	ó 162	• 178	• 194	• 210	• 226	• 242	-2
â 131	Ô 147	ú 163	• 179	• 195	• 211	• 227	• 243	-3
ä 132	Ö 148	ñ 164	• 180	• 196	• 212	• 228	• 244	-4
à 133	Ö 149	Ñ 165	• 181	• 197	• 213	• 229	• 245	-5
å 134	Û 150	a 166	• 182	• 198	• 214	µ 230	÷ 246	-6
ç 135	Û 151	o 167	• 183	• 199	• 215	• 231	• 247	-7
ê 136	Ÿ 152	ı 168	• 184	• 200	• 216	• 232	° 248	-8
ë 137	Ö 153	• 169	• 185	• 201	• 217	• 233	• 249	-9
è 138	Ü 154	¬ 170	• 186	• 202	• 218	• 234	• 250	-A
ï 139	¢ 155	½ 171	• 187	• 203	• 219	• 235	• 251	-B
î 140	£ 156	¼ 172	• 188	• 204	• 220	• 236	• 252	-C
ì 141	¥ 157	ı 173	• 189	• 205	• 221	• 237	² 253	-D
Ä 142	Pt 158	« 174	• 190	• 206	• 222	• 238	• 254	-E
Å 143	f 159	» 175	• 191	• 207	• 223	• 239	SP 255	-F

\* Mappings of printable characters in Columns 8 and 9 only apply when using IBM #2 control codes.

**IBM #2 CODE PAGE 437 (HEBREW)**

	0-*	1-*	2-	3-	4-	5-	6-	7-
0			<b>SP</b> 32	<b>0</b> 48	<b>@</b> 64	<b>P</b> 80	<b>`</b> 96	<b>p</b> 112
-1			<b>!</b> 33	<b>1</b> 49	<b>A</b> 65	<b>Q</b> 81	<b>a</b> 97	<b>q</b> 113
-2			<b>"</b> 34	<b>2</b> 50	<b>B</b> 66	<b>R</b> 82	<b>b</b> 98	<b>r</b> 114
-3	<b>♥</b> 3		<b>#</b> 35	<b>3</b> 51	<b>C</b> 67	<b>S</b> 83	<b>c</b> 99	<b>s</b> 115
-4	<b>♦</b> 4		<b>\$</b> 36	<b>4</b> 52	<b>D</b> 68	<b>T</b> 84	<b>d</b> 100	<b>t</b> 116
-5	<b>♣</b> 5	<b>§</b> 21	<b>%</b> 37	<b>5</b> 53	<b>E</b> 69	<b>U</b> 85	<b>e</b> 101	<b>u</b> 117
-6	<b>♠</b> 6		<b>&amp;</b> 38	<b>6</b> 54	<b>F</b> 70	<b>V</b> 86	<b>f</b> 102	<b>v</b> 118
-7			<b>'</b> 39	<b>7</b> 55	<b>G</b> 71	<b>W</b> 87	<b>g</b> 103	<b>w</b> 119
-8			<b>(</b> 40	<b>8</b> 56	<b>H</b> 72	<b>X</b> 88	<b>h</b> 104	<b>x</b> 120
-9			<b>)</b> 41	<b>9</b> 57	<b>I</b> 73	<b>Y</b> 89	<b>i</b> 105	<b>y</b> 121
-A			<b>*</b> 42	<b>:</b> 58	<b>J</b> 74	<b>Z</b> 90	<b>j</b> 106	<b>z</b> 122
-B			<b>+</b> 43	<b>;</b> 59	<b>K</b> 75	<b>[</b> 91	<b>k</b> 107	<b>{</b> 123
-C			<b>,</b> 44	<b>&lt;</b> 60	<b>L</b> 76	<b>\</b> 92	<b>l</b> 108	<b>!</b> 124
-D			<b>-</b> 45	<b>=</b> 61	<b>M</b> 77	<b>]</b> 93	<b>m</b> 109	<b>}</b> 125
-E			<b>.</b> 46	<b>&gt;</b> 62	<b>N</b> 78	<b>^</b> 94	<b>n</b> 110	<b>~</b> 126
-F			<b>/</b> 47	<b>?</b> 63	<b>O</b> 79	<b>_</b> 95	<b>o</b> 111	<b></b> 127

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\* Mappings of printable characters in Columns 0 and 1 only apply when using IBM #2 control codes.

8-*	9-*	A-	B-	C-	D-	E-	F-	
à 128	ð 144	á 160	• 176	• 192	• 208	• 224	• 240	0
á 129	ñ 145	í 161	• 177	• 193	• 209	ß 225	± 241	-1
â 130	ò 146	ó 162	• 178	• 194	• 210	• 226	• 242	-2
ã 131	ó 147	ú 163	• 179	• 195	• 211	• 227	• 243	-3
ä 132	ô 148	ñ 164	• 180	• 196	• 212	• 228	• 244	-4
å 133	ö 149	Ñ 165	• 181	• 197	• 213	• 229	• 245	-5
æ 134	ö 150	ä 166	• 182	• 198	• 214	µ 230	÷ 246	-6
ç 135	÷ 151	ø 167	• 183	• 199	• 215	• 231	• 247	-7
è 136	ø 152	¿ 168	• 184	• 200	• 216	• 232	° 248	-8
é 137	ù 153	• 169	• 185	• 201	• 217	• 233	• 249	-9
ê 138	ú 154	¬ 170	• 186	• 202	• 218	• 234	• 250	-A
ë 139	¢ 155	½ 171	• 187	• 203	• 219	• 235	• 251	-B
ì 140	£ 156	¼ 172	• 188	• 204	• 220	• 236	• 252	-C
í 141	¥ 157	¡ 173	• 189	• 205	• 221	• 237	² 253	-D
î 142	₣ 158	« 174	• 190	• 206	• 222	• 238	• 254	-E
ï 143	ƒ 159	» 175	• 191	• 207	• 223	• 239	SP 255	-F

\* Mappings of printable characters in Columns 8 and 9 only apply when using IBM #2 control codes.

**IBM CODE PAGE 850 (MULTILINGUAL)**

	0-*	1-*	2-	3-	4-	5-	6-	7-
0			<b>SP</b> 32	<b>0</b> 48	<b>@</b> 64	<b>P</b> 80	<b>`</b> 96	<b>p</b> 112
-1			<b>!</b> 33	<b>1</b> 49	<b>A</b> 65	<b>Q</b> 81	<b>a</b> 97	<b>q</b> 113
-2			<b>"</b> 34	<b>2</b> 50	<b>B</b> 66	<b>R</b> 82	<b>b</b> 98	<b>r</b> 114
-3	<b>♥</b> 3		<b>#</b> 35	<b>3</b> 51	<b>C</b> 67	<b>S</b> 83	<b>c</b> 99	<b>s</b> 115
-4	<b>♦</b> 4		<b>\$</b> 36	<b>4</b> 52	<b>D</b> 68	<b>T</b> 84	<b>d</b> 100	<b>t</b> 116
-5	<b>♣</b> 5	<b>§</b> 21	<b>%</b> 37	<b>5</b> 53	<b>E</b> 69	<b>U</b> 85	<b>e</b> 101	<b>u</b> 117
-6	<b>♠</b> 6		<b>&amp;</b> 38	<b>6</b> 54	<b>F</b> 70	<b>V</b> 86	<b>f</b> 102	<b>v</b> 118
-7			<b>'</b> 39	<b>7</b> 55	<b>G</b> 71	<b>W</b> 87	<b>g</b> 103	<b>w</b> 119
-8			<b>(</b> 40	<b>8</b> 56	<b>H</b> 72	<b>X</b> 88	<b>h</b> 104	<b>x</b> 120
-9			<b>)</b> 41	<b>9</b> 57	<b>I</b> 73	<b>Y</b> 89	<b>i</b> 105	<b>y</b> 121
-A			<b>*</b> 42	<b>:</b> 58	<b>J</b> 74	<b>Z</b> 90	<b>j</b> 106	<b>z</b> 122
-B			<b>+</b> 43	<b>;</b> 59	<b>K</b> 75	<b>[</b> 91	<b>k</b> 107	<b>{</b> 123
-C			<b>,</b> 44	<b>&lt;</b> 60	<b>L</b> 76	<b>\</b> 92	<b>l</b> 108	<b>!</b> 124
-D			<b>-</b> 45	<b>=</b> 61	<b>M</b> 77	<b>]</b> 93	<b>m</b> 109	<b>}</b> 125
-E			<b>.</b> 46	<b>&gt;</b> 62	<b>N</b> 78	<b>^</b> 94	<b>n</b> 110	<b>~</b> 126
-F			<b>/</b> 47	<b>?</b> 63	<b>O</b> 79	<b>_</b> 95	<b>o</b> 111	<b></b> 127

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\* Mappings of printable characters in Columns 0 and 1 only apply when using IBM #2 control codes.



8-*	9-*	A-	B-	C-	D-	E-	F-	
Ç 128	É 144	á 160	• 176	• 192	đ 208	Ó 224	- 240	0
ü 129	æ 145	í 161	• 177	• 193	Đ 209	ß 225	± 241	-1
é 130	Æ 146	ó 162	• 178	• 194	Ê 210	Ô 226	= 242	-2
â 131	ô 147	ú 163	• 179	• 195	Ë 211	Ò 227	¾ 243	-3
ä 132	ö 148	ñ 164	• 180	• 196	È 212	ō 228	¶ 244	-4
à 133	ò 149	Ñ 165	À 181	• 197	¹ 213	Õ 229	§ 245	-5
å 134	û 150	ª 166	Ã 182	ã 198	Í 214	µ 230	÷ 246	-6
ç 135	ù 151	º 167	Ä 183	Ä 199	Î 215	þ 231	 247	-7
ê 136	ÿ 152	¿ 168	© 184	• 200	İ 216	þ 232	° 248	-8
ë 137	Ö 153	® 169	• 185	• 201	• 217	Ú 233	° 249	-9
è 138	Ü 154	ª 170	• 186	• 202	• 218	Û 234	² 250	-A
ï 139	ø 155	½ 171	• 187	• 203	• 219	Ü 235	³ 251	-B
î 140	£ 156	¼ 172	• 188	• 204	• 220	Ý 236	³ 252	-C
ì 141	Ø 157	¡ 173	¢ 189	• 205	ı 221	Ý 237	² 253	-D
Ä 142	× 158	« 174	¥ 190	• 206	İ 222	- 238	• 254	-E
Å 143	f 159	» 175	• 191	¤ 207	• 223	' 239	SP 255	-F

\* Mappings of printable characters in Columns 8 and 9 only apply when using IBM #2 control codes.

**IBM CODE PAGE 860 (PORTUGAL)**

	0-*	1-*	2-	3-	4-	5-	6-	7-
0			<b>SP</b> 32	<b>0</b> 48	<b>@</b> 64	<b>P</b> 80	<b>`</b> 96	<b>p</b> 112
-1			<b>!</b> 33	<b>1</b> 49	<b>A</b> 65	<b>Q</b> 81	<b>a</b> 97	<b>q</b> 113
-2			<b>"</b> 34	<b>2</b> 50	<b>B</b> 66	<b>R</b> 82	<b>b</b> 98	<b>r</b> 114
-3	<b>♥</b> 3		<b>#</b> 35	<b>3</b> 51	<b>C</b> 67	<b>S</b> 83	<b>c</b> 99	<b>s</b> 115
-4	<b>♦</b> 4		<b>\$</b> 36	<b>4</b> 52	<b>D</b> 68	<b>T</b> 84	<b>d</b> 100	<b>t</b> 116
-5	<b>♣</b> 5	<b>§</b> 21	<b>%</b> 37	<b>5</b> 53	<b>E</b> 69	<b>U</b> 85	<b>e</b> 101	<b>u</b> 117
-6	<b>♠</b> 6		<b>&amp;</b> 38	<b>6</b> 54	<b>F</b> 70	<b>V</b> 86	<b>f</b> 102	<b>v</b> 118
-7			<b>'</b> 39	<b>7</b> 55	<b>G</b> 71	<b>W</b> 87	<b>g</b> 103	<b>w</b> 119
-8			<b>(</b> 40	<b>8</b> 56	<b>H</b> 72	<b>X</b> 88	<b>h</b> 104	<b>x</b> 120
-9			<b>)</b> 41	<b>9</b> 57	<b>I</b> 73	<b>Y</b> 89	<b>i</b> 105	<b>y</b> 121
-A			<b>*</b> 42	<b>:</b> 58	<b>J</b> 74	<b>Z</b> 90	<b>j</b> 106	<b>z</b> 122
-B			<b>+</b> 43	<b>;</b> 59	<b>K</b> 75	<b>[</b> 91	<b>k</b> 107	<b>{</b> 123
-C			<b>,</b> 44	<b>&lt;</b> 60	<b>L</b> 76	<b>\</b> 92	<b>l</b> 108	<b>!</b> 124
-D			<b>-</b> 45	<b>=</b> 61	<b>M</b> 77	<b>]</b> 93	<b>m</b> 109	<b>}</b> 125
-E			<b>.</b> 46	<b>&gt;</b> 62	<b>N</b> 78	<b>^</b> 94	<b>n</b> 110	<b>~</b> 126
-F			<b>/</b> 47	<b>?</b> 63	<b>O</b> 79	<b>_</b> 95	<b>o</b> 111	<b></b> 127

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\* Mappings of printable characters in Columns 0 and 1 only apply when using IBM #2 control codes.

8-*	9-*	A-	B-	C-	D-	E-	F-	
Ç 128	É 144	á 160	• 176	• 192	• 208	• 224	• 240	0
ü 129	À 145	í 161	• 177	• 193	• 209	ß 225	± 241	-1
é 130	È 146	ó 162	• 178	• 194	• 210	• 226	• 242	-2
â 131	ô 147	û 163	• 179	• 195	• 211	• 227	• 243	-3
ã 132	õ 148	ñ 164	• 180	• 196	• 212	• 228	• 244	-4
à 133	ò 149	Ñ 165	• 181	• 197	• 213	• 229	• 245	-5
Á 134	Ú 150	ª 166	• 182	• 198	• 214	µ 230	÷ 246	-6
ç 135	ù 151	º 167	• 183	• 199	• 215	• 231	• 247	-7
ê 136	Ì 152	¿ 168	• 184	• 200	• 216	• 232	° 248	-8
Ê 137	Õ 153	Ò 169	• 185	• 201	• 217	• 233	• 249	-9
è 138	Ü 154	ª 170	• 186	• 202	• 218	• 234	• 250	-A
Î 139	¢ 155	½ 171	• 187	• 203	• 219	• 235	• 251	-B
Ô 140	£ 156	¼ 172	• 188	• 204	• 220	• 236	• 252	-C
ì 141	Û 157	ï 173	• 189	• 205	• 221	∅ 237	² 253	-D
Ä 142	₣ 158	« 174	• 190	• 206	• 222	• 238	• 254	-E
Å 143	Ó 159	» 175	• 191	• 207	• 223	• 239	SP 255	-F

\* Mappings of printable characters in Columns 8 and 9 only apply when using IBM #2 control codes.

**DEC NATIONAL-USE CHARACTER MAP\***

	0-/8-	1-/9-	2-/A-	3-/B-	4-/C-	5-/D-	6-/E-	7-/F-
0			<b>SP</b> 32/160	<b>0</b> 48/176	<b>@</b> 64/192	<b>P</b> 80/208	<b>`</b> 96/224	<b>p</b> 112/240
-1			<b>!</b> 33/161	<b>1</b> 49/177	<b>A</b> 65/193	<b>Q</b> 81/209	<b>a</b> 97/225	<b>q</b> 113/241
-2			<b>"</b> 34/162	<b>2</b> 50/178	<b>B</b> 66/194	<b>R</b> 82/210	<b>b</b> 98/226	<b>r</b> 114/242
-3			<b>#</b> 35/163	<b>3</b> 51/179	<b>C</b> 67/195	<b>S</b> 83/211	<b>c</b> 99/227	<b>s</b> 115/243
-4			<b>\$</b> 36/164	<b>4</b> 52/180	<b>D</b> 68/196	<b>T</b> 84/212	<b>d</b> 100/228	<b>t</b> 116/244
-5			<b>%</b> 37/165	<b>5</b> 53/181	<b>E</b> 69/197	<b>U</b> 85/213	<b>e</b> 101/229	<b>u</b> 117/245
-6			<b>&amp;</b> 38/166	<b>6</b> 54/182	<b>F</b> 70/198	<b>V</b> 86/214	<b>f</b> 102/230	<b>v</b> 118/246
-7			<b>'</b> 39/167	<b>7</b> 55/183	<b>G</b> 71/199	<b>W</b> 87/215	<b>g</b> 103/231	<b>w</b> 119/247
-8			<b>(</b> 40/168	<b>8</b> 56/184	<b>H</b> 72/200	<b>X</b> 88/216	<b>h</b> 104/232	<b>x</b> 120/248
-9			<b>)</b> 41/169	<b>9</b> 57/185	<b>I</b> 73/201	<b>Y</b> 89/217	<b>i</b> 105/233	<b>y</b> 121/249
-A			<b>*</b> 42/170	<b>:</b> 58/186	<b>J</b> 74/202	<b>Z</b> 90/218	<b>j</b> 106/234	<b>z</b> 122/250
-B			<b>+</b> 43/171	<b>;</b> 59/187	<b>K</b> 75/203	<b>[</b> 91/219	<b>k</b> 107/235	<b>{</b> 123/251
-C			<b>,</b> 44/172	<b>&lt;</b> 60/188	<b>L</b> 76/204	<b>\</b> 92/220	<b>l</b> 108/236	<b>}</b> 124/252
-D			<b>-</b> 45/173	<b>=</b> 61/189	<b>M</b> 77/205	<b>]</b> 93/221	<b>m</b> 109/237	<b>}</b> 125/253
-E			<b>.</b> 46/174	<b>&gt;</b> 62/190	<b>N</b> 78/206	<b>^</b> 94/222	<b>n</b> 110/238	<b>~</b> 126/254
-F			<b>/</b> 47/175	<b>?</b> 63/191	<b>O</b> 79/207	<b>_</b> 95/223	<b>o</b> 111/239	<b></b> 127/255

\* Shown with 11 double-boxed U.S. character substitutions. See Page D-37 for other character substitutions.

## DEC MULTILINGUAL CHARACTER MAP

	0-/8-	1-/9-	2-/A-	3-/B-	4-/C-	5-/D-	6-/E-	7-/F-
0			<b>SP</b> 32/160	<b>Ø</b> 48/176	<b>À</b> 64/192		<b>à</b> 96/224	112/240
-1			<b>ì</b> 33/161	<b>±</b> 49/177	<b>Á</b> 65/193	<b>Ñ</b> 81/209	<b>á</b> 97/225	<b>ñ</b> 113/241
-2			<b>¢</b> 34/162	<b>²</b> 50/178	<b>Â</b> 66/194	<b>Ö</b> 82/210	<b>â</b> 98/226	<b>ò</b> 114/242
-3			<b>£</b> 35/163	<b>³</b> 51/179	<b>Ã</b> 67/195	<b>Ó</b> 83/211	<b>ã</b> 99/227	<b>ó</b> 115/243
-4					<b>Ä</b> 68/196	<b>Ö</b> 84/212	<b>ä</b> 100/228	<b>ô</b> 116/244
-5			<b>¥</b> 37/165	<b>μ</b> 53/181	<b>Å</b> 69/197	<b>Õ</b> 85/213	<b>å</b> 101/229	<b>õ</b> 117/245
-6				<b>¶</b> 54/182	<b>Æ</b> 70/198	<b>Ö</b> 86/214	<b>æ</b> 102/230	<b>ö</b> 118/246
-7			<b>§</b> 39/167	<b>·</b> 55/183	<b>Ç</b> 71/199	<b>Œ</b> 87/215	<b>ç</b> 103/231	<b>œ</b> 119/247
-8			<b>¤</b> 40/168		<b>È</b> 72/200	<b>Ø</b> 88/216	<b>è</b> 104/232	<b>ø</b> 120/248
-9			<b>©</b> 41/169	<b>¹</b> 57/185	<b>É</b> 73/201	<b>Ù</b> 89/217	<b>é</b> 105/233	<b>ù</b> 121/249
-A			<b>ª</b> 42/170	<b>º</b> 58/186	<b>Ê</b> 74/202	<b>Ú</b> 90/218	<b>ê</b> 106/234	<b>ú</b> 122/250
-B			<b>«</b> 43/171	<b>»</b> 59/187	<b>Ë</b> 75/203	<b>Û</b> 91/219	<b>ë</b> 107/235	<b>û</b> 123/251
-C				<b>¼</b> 60/188	<b>Ì</b> 76/204	<b>Ü</b> 92/220	<b>ì</b> 108/236	<b>ü</b> 124/252
-D				<b>½</b> 61/189	<b>Í</b> 77/205	<b>Ý</b> 93/221	<b>í</b> 109/237	<b>ÿ</b> 125/253
-E					<b>Î</b> 78/206		<b>î</b> 110/238	126/254
-F				<b>¿</b> 63/191	<b>Ï</b> 79/207	<b>ß</b> 95/223	<b>ï</b> 111/239	127/255

## DEC HEBREW CHARACTER MAP

	0-/8-	1-/9-	2-/A-	3-/B-	4-/C-	5-/D-	6-/E-	7-/F-
0			<b>SP</b> 32/160	<b>0</b> 48/176	<b>@</b> 64/192	<b>P</b> 80/208	<b>à</b> 96/224	<b>ð</b> 112/240
-1			<b>!</b> 33/161	<b>1</b> 49/177	<b>A</b> 65/193	<b>Q</b> 81/209	<b>á</b> 97/225	<b>ñ</b> 113/241
-2			<b>"</b> 34/162	<b>2</b> 50/178	<b>B</b> 66/194	<b>R</b> 82/210	<b>â</b> 98/226	<b>ô</b> 114/242
-3			<b>#</b> 35/163	<b>3</b> 51/179	<b>C</b> 67/195	<b>S</b> 83/211	<b>ã</b> 99/227	<b>ó</b> 115/243
-4			<b>\$</b> 36/164	<b>4</b> 52/180	<b>D</b> 68/196	<b>T</b> 84/212	<b>ä</b> 100/228	<b>ö</b> 116/244
-5			<b>%</b> 37/165	<b>5</b> 53/181	<b>E</b> 69/197	<b>U</b> 85/213	<b>å</b> 101/229	<b>ø</b> 117/245
-6			<b>&amp;</b> 38/166	<b>6</b> 54/182	<b>F</b> 70/198	<b>V</b> 86/214	<b>æ</b> 102/230	<b>ö</b> 118/246
-7			<b>'</b> 39/167	<b>7</b> 55/183	<b>G</b> 71/199	<b>W</b> 87/215	<b>ç</b> 103/231	<b>÷</b> 119/247
-8			<b>(</b> 40/168	<b>8</b> 56/184	<b>H</b> 72/200	<b>X</b> 88/216	<b>è</b> 104/232	<b>ø</b> 120/248
-9			<b>)</b> 41/169	<b>9</b> 57/185	<b>I</b> 73/201	<b>Y</b> 89/217	<b>é</b> 105/233	<b>ù</b> 121/249
-A			<b>*</b> 42/170	<b>:</b> 58/186	<b>J</b> 74/202	<b>Z</b> 90/218	<b>ê</b> 106/234	<b>ú</b> 122/250
-B			<b>+</b> 43/171	<b>;</b> 59/187	<b>K</b> 75/203	<b>[</b> 91/219	<b>ë</b> 107/235	<b>{</b> 123/251
-C			<b>,</b> 44/172	<b>&lt;</b> 60/188	<b>L</b> 76/204	<b>\</b> 92/220	<b>ì</b> 108/236	<b>ì</b> 124/252
-D			<b>-</b> 45/173	<b>=</b> 61/189	<b>M</b> 77/205	<b>]</b> 93/221	<b>í</b> 109/237	<b>}</b> 125/253
-E			<b>.</b> 46/174	<b>&gt;</b> 62/190	<b>N</b> 78/206	<b>^</b> 94/222	<b>î</b> 110/238	<b>~</b> 126/254
-F			<b>/</b> 47/175	<b>?</b> 63/191	<b>O</b> 79/207	<b>_</b> 95/223	<b>ï</b> 111/239	<b></b> 127/255

## DEC VT100 LINE DRAW CHARACTER MAP

	0-/8-	1-/9-	2-/A-	3-/B-	4-/C-	5-/D-	6-/E-	7-/F-
0			<b>SP</b> 32/160	<b>0</b> 48/176	<b>@</b> 64/192	<b>P</b> 80/208	<b>♦</b> 96/224	<b>—</b> 112/240
-1			<b>!</b> 33/161	<b>1</b> 49/177	<b>A</b> 65/193	<b>Q</b> 81/209	<b>•</b> 97/225	<b>—</b> 113/241
-2			<b>"</b> 34/162	<b>2</b> 50/178	<b>B</b> 66/194	<b>R</b> 82/210	<b>H<sub>T</sub></b> 98/226	<b>—</b> 114/242
-3			<b>#</b> 35/163	<b>3</b> 51/179	<b>C</b> 67/195	<b>S</b> 83/211	<b>F<sub>F</sub></b> 99/227	<b>—</b> 115/243
-4			<b>\$</b> 36/164	<b>4</b> 52/180	<b>D</b> 68/196	<b>T</b> 84/212	<b>C<sub>R</sub></b> 100/228	<b>•</b> 116/244
-5			<b>%</b> 37/165	<b>5</b> 53/181	<b>E</b> 69/197	<b>U</b> 85/213	<b>L<sub>F</sub></b> 101/229	<b>•</b> 117/245
-6			<b>&amp;</b> 38/166	<b>6</b> 54/182	<b>F</b> 70/198	<b>V</b> 86/214	<b>°</b> 102/230	<b>•</b> 118/246
-7			<b>'</b> 39/167	<b>7</b> 55/183	<b>G</b> 71/199	<b>W</b> 87/215	<b>±</b> 103/231	<b>•</b> 119/247
-8			<b>(</b> 40/168	<b>8</b> 56/184	<b>H</b> 72/200	<b>X</b> 88/216	<b>N<sub>L</sub></b> 104/232	<b>•</b> 120/248
-9			<b>)</b> 41/169	<b>9</b> 57/185	<b>I</b> 73/201	<b>Y</b> 89/217	<b>V<sub>T</sub></b> 105/233	<b>•</b> 121/249
-A			<b>*</b> 42/170	<b>:</b> 58/186	<b>J</b> 74/202	<b>Z</b> 90/218	<b>•</b> 106/234	<b>•</b> 122/250
-B			<b>+</b> 43/171	<b>;</b> 59/187	<b>K</b> 75/203	<b>[</b> 91/219	<b>•</b> 107/235	<b>•</b> 123/251
-C			<b>,</b> 44/172	<b>&lt;</b> 60/188	<b>L</b> 76/204	<b>\</b> 92/220	<b>•</b> 108/236	<b>≠</b> 124/252
-D			<b>-</b> 45/173	<b>=</b> 61/189	<b>M</b> 77/205	<b>]</b> 93/221	<b>•</b> 109/237	<b>£</b> 125/253
-E			<b>.</b> 46/174	<b>&gt;</b> 62/190	<b>N</b> 78/206	<b>^</b> 94/222	<b>•</b> 110/238	<b>▪</b> 126/254
-F			<b>/</b> 47/175	<b>?</b> 63/191	<b>O</b> 79/207	<b>—</b> 95/223	<b>—</b> 111/239	<b>—</b> 127/255

## OCR A OVERLAY CHARACTER MAP\*

	0-	1-	2-	3-	4-	5-	6-	7-
0				<b>0</b> 48		<b>P</b> 80		
-1				<b>1</b> 49	<b>A</b> 65	<b>Q</b> 81		
-2			<b>"</b> 34	<b>2</b> 50	<b>B</b> 66	<b>R</b> 82		
-3				<b>3</b> 51	<b>C</b> 67	<b>S</b> 83		
-4			<b>\$</b> 36	<b>4</b> 52	<b>D</b> 68	<b>T</b> 84		
-5				<b>5</b> 53	<b>E</b> 69	<b>U</b> 85		
-6				<b>6</b> 54	<b>F</b> 70	<b>V</b> 86		
-7				<b>7</b> 55	<b>G</b> 71	<b>W</b> 87		
-8				<b>8</b> 56	<b>H</b> 72	<b>X</b> 88		
-9				<b>9</b> 57	<b>I</b> 73	<b>Y</b> 89		
-A					<b>J</b> 74	<b>Z</b> 90		
-B			<b>+</b> 43		<b>K</b> 75			
-C			<b>,</b> 44	<b>&lt;</b> 60	<b>L</b> 76	<b>\</b> 92		
-D					<b>M</b> 77			
-E			<b>.</b> 46	<b>&gt;</b> 62	<b>N</b> 78			
-F			<b>/</b> 47		<b>O</b> 79			

\* Only characters in unshaded areas are overlaid onto the active character set.



## OCR B OVERLAY CHARACTER MAP\*

	0-	1-	2-	3-	4-	5-	6-	7-
0				<b>0</b> 48		<b>P</b> 80		
-1				<b>1</b> 49	<b>A</b> 65			
-2				<b>2</b> 50				
-3				<b>3</b> 51	<b>C</b> 67			
-4				<b>4</b> 52		<b>T</b> 84		
-5				<b>5</b> 53	<b>E</b> 69	<b>U</b> 85		
-6				<b>6</b> 54		<b>V</b> 86		
-7				<b>7</b> 55				
-8				<b>8</b> 56		<b>X</b> 88		
-9				<b>9</b> 57				
-A								
-B			<b>+</b> 43					
-C			<b>,</b> 44	<b>&lt;</b> 60				
-D								
-E			<b>.</b> 46	<b>&gt;</b> 62	<b>N</b> 78			
-F			<b>/</b> 47					

\* Only characters in unshaded areas are overlaid onto the active character set.

## CHARACTER SUBSTITUTIONS FOR EPSON NATIONAL-USE CHARACTER MAP\*

Decimal Hexadecimal	35 23	36 24	64 40	91 5B	92 5C	93 5D	94 5E	96 60	123 7B	124 7C	125 7D	126 7E
Decimal Hexadecimal	163 A3	164 A4	192 C0	219 DB	220 DC	221 DD	222 DE	224 E0	251 FB	252 FC	253 FD	254 FE
United States**	#	\$	@	[	\	]	^	`	{		}	~
France	#	\$	à	°	ç	§	^	`	é	ù	è	¨
Germany	#	\$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
United Kingdom	£	\$	@	[	\	]	^	`	{		}	~
Denmark	#	\$	@	Æ	Ø	Å	^	`	æ	ø	å	~
Sweden	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
Italy (Epson)	#	\$	@	°	\	é	^	ù	à	ò	è	ì
Spain	Pt	\$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
Japan	#	\$	@	[	¥	]	^	`	{		}	~
Norway	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ú
Denmark II	#	\$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ú
Spain II	#	\$	á	¡	Ñ	¿	é	`	í	ñ	ó	ú
Latin America	#	\$	á	¡	Ñ	¿	é	ü	í	ñ	ó	ú
Italy (ANSI)	£	\$	§	°	ç	é	^	ù	à	ò	è	ì

\* Character substitutions in the upper half of the resulting character set are italics.

\*\* See Page D-18 for the complete Epson U.S. Character Map.

## CHARACTER SUBSTITUTIONS FOR DEC NATIONAL-USE CHARACTER MAP

Decimal Hexadecimal	35 23	64 40	91 5B	92 5C	93 5D	94 5E	96 60	123 7B	124 7C	125 7D	126 7E
Decimal Hexadecimal	163 A3	192 C0	219 DB	220 DC	221 DD	222 DE	224 E0	251 FB	252 FC	253 FD	254 FE
Canada (French)	#	à	â	ç	ê	î	ô	é	ù	è	û
Finland	#	@	Ä	Ö	Å	Ü	é	ä	ö	â	ü
France	£	à	°	ç	§	^	`	é	ù	è	''
Germany	#	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
Italy (ANSI)	£	§	°	ç	é	^	ù	à	ò	è	ì
Norway/Denmark	#	Ä	Æ	Ø	Å	Ü	ä	æ	ø	å	ü
Spain	£	§	¡	Ñ	¿	^	`	°	ñ	ç	~
Sweden	#	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
United Kingdom	£	@	[	\	]	^	`	{		}	~
United States*	#	@	[	\	]	^	`	{		}	~

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\* See Page D-30 for the complete DEC U.S. Character Map.

## THE CHARACTER SET

The character set is the result of selecting control code and character code maps. For example, in the configuration menu., if you select the IBM #2 control code map (Page D-13) and the IBM Multilingual Code Page 850 (Page D-26), you would have the character set shown on Pages D-40 and D-41.

To print out a copy of your active character set, see Page 34. See Page 37 through 39 for printouts of factory-default character sets.

## EPSON ENHANCED CHARACTER SETS

Two Epson character map overlays can be used to map over some of the characters in the active Epson character set. These Epson character overlays (Pages D-42 and D-44) are chosen using control commands:

- **ESC I (1)** overlays portions of Columns 0, 1, 8, and 9 of the active Epson character set with printable characters. [Use **ESC I (Ø)** to remove the overlay.]
- **ESC 6** overlays portions of Columns 8 and 9 of the active Epson character set with printable characters. (Use **ESC 7** to remove the overlay.)

Use **ESC I (1)** together with **ESC 6** to create the Epson National-Use Standard Code Page Character Set shown on Pages D-46 and D-47.

## IBM ALL CHARACTER CHARACTER SET

IBM emulation has a standard character set called the "all-character character set."

The all-character character set consists of the active character set and a temporary overlay (Pages D-48 and D-49). The overlay temporarily maps over the control codes in Columns 0 and 1. Pages D-50 and D-51 show the temporary all-character overlay used with the IBM #2 Multilingual Character Set.

The IBM control command to temporarily apply the overlay is **ESC \ (n1) (n2)**. The two-digit decimal number "n1n2" specifies the number of characters to be printed from the all-character character set. After the specified characters, the printer reverts to the active IBM character set.

*Note:* The all-character character set is available only in the IBM emulation. **ESC \ (n1) (n2)** is ignored in the IBM mode of the Epson emulation.

**IBM #2 MULTILINGUAL CHARACTER SET**

	0-	1-	2-	3-	4-	5-	6-	7-
0	<b>NUL</b> 0	16	<b>SP</b> 32	<b>0</b> 48	<b>@</b> 64	<b>P</b> 80	<b>`</b> 96	<b>p</b> 112
-1	<b>SOH</b> 1	<b>DC1</b> 17	<b>!</b> 33	<b>1</b> 49	<b>A</b> 65	<b>Q</b> 81	<b>a</b> 97	<b>q</b> 113
-2	2	<b>DC2</b> 18	<b>"</b> 34	<b>2</b> 50	<b>B</b> 66	<b>R</b> 82	<b>b</b> 98	<b>r</b> 114
-3	<b>♥</b> 3	<b>DC3</b> 19	<b>#</b> 35	<b>3</b> 51	<b>C</b> 67	<b>S</b> 83	<b>c</b> 99	<b>s</b> 115
-4	<b>♦</b> 4	<b>DC4</b> 20	<b>\$</b> 36	<b>4</b> 52	<b>D</b> 68	<b>T</b> 84	<b>d</b> 100	<b>t</b> 116
-5	<b>♣</b> 5	<b>§</b> 21	<b>%</b> 37	<b>5</b> 53	<b>E</b> 69	<b>U</b> 85	<b>e</b> 101	<b>u</b> 117
-6	<b>♠</b> 6	22	<b>&amp;</b> 38	<b>6</b> 54	<b>F</b> 70	<b>V</b> 86	<b>f</b> 102	<b>v</b> 118
-7	<b>BEL</b> 7	23	<b>'</b> 39	<b>7</b> 55	<b>G</b> 71	<b>W</b> 87	<b>g</b> 103	<b>w</b> 119
-8	<b>BS</b> 8	<b>CAN</b> 24	<b>(</b> 40	<b>8</b> 56	<b>H</b> 72	<b>X</b> 88	<b>h</b> 104	<b>x</b> 120
-9	<b>HT</b> 9	25	<b>)</b> 41	<b>9</b> 57	<b>I</b> 73	<b>Y</b> 89	<b>i</b> 105	<b>y</b> 121
-A	<b>LF</b> 10	26	<b>*</b> 42	<b>:</b> 58	<b>J</b> 74	<b>Z</b> 90	<b>j</b> 106	<b>z</b> 122
-B	<b>VT</b> 11	<b>ESC</b> 27	<b>+</b> 43	<b>;</b> 59	<b>K</b> 75	<b>[</b> 91	<b>k</b> 107	<b>{</b> 123
-C	<b>FF</b> 12	28	<b>,</b> 44	<b>&lt;</b> 60	<b>L</b> 76	<b>\</b> 92	<b>l</b> 108	<b>!</b> 124
-D	<b>CR</b> 13	29	<b>-</b> 45	<b>=</b> 61	<b>M</b> 77	<b>]</b> 93	<b>m</b> 109	<b>}</b> 125
-E	<b>SO</b> 14	30	<b>.</b> 46	<b>&gt;</b> 62	<b>N</b> 78	<b>^</b> 94	<b>n</b> 110	<b>~</b> 126
-F	<b>SI</b> 15	31	<b>/</b> 47	<b>?</b> 63	<b>O</b> 79	<b>_</b> 95	<b>o</b> 111	127

8-	9-	A-	B-	C-	D-	E-	F-	
Ç 128	É 144	á 160	• 176	• 192	ð 208	Ó 224	- 240	0
ü 129	æ 145	í 161	• 177	• 193	Ð 209	ß 225	± 241	-1
é 130	Æ 146	ó 162	• 178	• 194	Ê 210	Ô 226	= 242	-2
â 131	ô 147	ú 163	• 179	• 195	Ë 211	Ò 227	¾ 243	-3
ä 132	ö 148	ñ 164	• 180	• 196	È 212	ō 228	¶ 244	-4
à 133	ò 149	Ñ 165	À 181	• 197	¹ 213	Õ 229	§ 245	-5
å 134	û 150	ª 166	Â 182	ã 198	Í 214	µ 230	÷ 246	-6
ç 135	ù 151	º 167	Ã 183	Ä 199	Î 215	þ 231	² 247	-7
ê 136	ÿ 152	¿ 168	© 184	• 200	Ï 216	þ 232	³ 248	-8
ë 137	Ö 153	® 169	• 185	• 201	• 217	Ú 233	´ 249	-9
è 138	Ü 154	ª 170	• 186	• 202	• 218	Û 234	µ 250	-A
ï 139	ø 155	½ 171	• 187	• 203	• 219	Ü 235	¶ 251	-B
î 140	£ 156	¼ 172	• 188	• 204	• 220	Ý 236	³ 252	-C
ì 141	Ø 157	¡ 173	¢ 189	• 205	ì 221	Ý 237	² 253	-D
Ä 142	× 158	« 174	¥ 190	• 206	Ì 222	- 238	• 254	-E
Å 143	f 159	» 175	• 191	¤ 207	• 223	' 239	SP 255	-F

**EPSON ESC I PRINTABLE CHARACTER OVERLAY\***

	0-	1-	2-	3-	4-	5-	6-	7-
0	à 0	§ 16						
-1		ß 17						
-2	ù 2							
-3	ò 3							
-4	ì 4							
-5	º 5	ø 21						
-6	£ 6	¨ 22						
-7		Ä 23						
-8		Ö 24						
-9		Û 25						
-A		ä 26						
-B								
-C		ü 28						
-D		É 29						
-E		é 30						
-F		¥ 31						

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\* Only characters in unshaded areas are overlaid onto the active character set.



8-	9-	A-	B-	C-	D-	E-	F-	
à 128	§ 144							0
è 129	ß 145							-1
ù 130								-2
ö 131								-3
ï 132								-4
ó 133	ø 149							-5
£ 134	“ 150							-6
	Ä 151							-7
	Ö 152							-8
	Ü 153							-9
	ä 154							-A
								-B
	ü 156							-C
	É 157							-D
	é 158							-E
	¥ 159							-F

## EPSON ESC 6 PRINTABLE CHARACTER EXPANSION OVERLAY\*

	0-	1-	2-	3-	4-	5-	6-	7-
0								
-1								
-2								
-3								
-4								
-5								
-6								
-7								
-8								
-9								
-A								
-B								
-C								
-D								
-E								
-F								

---

\* Only characters in unshaded areas are overlaid onto the active character set.

8-	9-	A-	B-	C-	D-	E-	F-	
à 128	§ 144							0
è 129	ß 145							-1
ù 130	Æ 146							-2
ò 131	æ 147							-3
ì 132	Ø 148							-4
ó 133	ø 149							-5
£ 134	“ 150							-6
í 135	Ä 151							-7
í 136	Ö 152							-8
Ñ 137	Ü 153							-9
ñ 138	ä 154							-A
π 139	ö 155							-B
P <sub>t</sub> 140	ü 156							-C
À 141	É 157							-D
â 142	é 158							-E
ç 143	¥ 159						Ø 255	-F

## EPSON STANDARD CODE PAGE CHARACTER SET\*

	0-	1-	2-	3-	4-	5-	6-	7-
<b>0</b>	à 0	§ 16	SP 32	0 48	@ 64	P 80	` 96	p 112
<b>-1</b>	SOH 1	ß 17	! 33	1 49	A 65	Q 81	a 97	q 113
<b>-2</b>	ù 2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114
<b>-3</b>	ò 3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115
<b>-4</b>	ì 4	DC4 20	\$ 36	4 52	D 68	T 84	d 100	t 116
<b>-5</b>	° 5	ø 21	% 37	5 53	E 69	U 85	e 101	u 117
<b>-6</b>	£ 6	.. 22	& 38	6 54	F 70	V 86	f 102	v 118
<b>-7</b>	BEL 7	Ä 23	' 39	7 55	G 71	W 87	g 103	w 119
<b>-8</b>	BS 8	Ö 24	( 40	8 56	H 72	X 88	h 104	x 120
<b>-9</b>	HT 9	Ü 25	) 41	9 57	I 73	Y 89	i 105	y 121
<b>-A</b>	LF 10	ä 26	* 42	: 58	J 74	Z 90	j 106	z 122
<b>-B</b>	VT 11	ESC 27	+ 43	; 59	K 75	[ 91	k 107	{ 123
<b>-C</b>	FF 12	ü 28	, 44	< 60	L 76	\ 92	l 108	! 124
<b>-D</b>	CR 13	É 29	- 45	= 61	M 77	] 93	m 109	} 125
<b>-E</b>	SO 14	é 30	. 46	> 62	N 78	^ 94	n 110	~ 126
<b>-F</b>	SI 15	¥ 31	/ 47	? 63	O 79	— 95	o 111	DEL 127

\* Based on U.S. National-Use Character Map with an 8-bit data interface.

8-	9-	A-	B-	C-	D-	E-	F-	
<b>à</b> 128	<b>§</b> 144	<b>SP</b> 160	<b>0</b> 176	<b>@</b> 192	<b>P</b> 208	<b>`</b> 224	<b>p</b> 240	<b>0</b>
<b>è</b> 129	<b>ß</b> 145	<b>!</b> 161	<b>1</b> 177	<b>A</b> 193	<b>Q</b> 209	<b>a</b> 225	<b>q</b> 241	<b>-1</b>
<b>ù</b> 130	<b>Æ</b> 146	<b>"</b> 162	<b>2</b> 178	<b>B</b> 194	<b>R</b> 210	<b>b</b> 226	<b>r</b> 242	<b>-2</b>
<b>ò</b> 131	<b>æ</b> 147	<b>#</b> 163	<b>3</b> 179	<b>C</b> 195	<b>S</b> 211	<b>c</b> 227	<b>s</b> 243	<b>-3</b>
<b>ì</b> 132	<b>Ø</b> 148	<b>\$</b> 164	<b>4</b> 180	<b>D</b> 196	<b>T</b> 212	<b>d</b> 228	<b>t</b> 244	<b>-4</b>
<b>°</b> 133	<b>ø</b> 149	<b>%</b> 165	<b>5</b> 181	<b>E</b> 197	<b>U</b> 213	<b>e</b> 229	<b>u</b> 245	<b>-5</b>
<b>£</b> 134	<b>ˆ</b> 150	<b>&amp;</b> 166	<b>6</b> 182	<b>F</b> 198	<b>V</b> 214	<b>f</b> 230	<b>v</b> 246	<b>-6</b>
<b>í</b> 135	<b>Ä</b> 151	<b>'</b> 167	<b>7</b> 183	<b>G</b> 199	<b>W</b> 215	<b>g</b> 231	<b>w</b> 247	<b>-7</b>
<b>¿</b> 136	<b>Ö</b> 152	<b>(</b> 168	<b>8</b> 184	<b>H</b> 200	<b>X</b> 216	<b>h</b> 232	<b>x</b> 248	<b>-8</b>
<b>Ñ</b> 137	<b>Ü</b> 153	<b>)</b> 169	<b>9</b> 185	<b>I</b> 201	<b>Y</b> 217	<b>i</b> 233	<b>y</b> 249	<b>-9</b>
<b>ñ</b> 138	<b>ä</b> 154	<b>*</b> 170	<b>:</b> 186	<b>J</b> 202	<b>Z</b> 218	<b>j</b> 234	<b>z</b> 250	<b>-A</b>
<b>ª</b> 139	<b>ö</b> 155	<b>+</b> 171	<b>;</b> 187	<b>K</b> 203	<b>[</b> 219	<b>k</b> 235	<b>{</b> 251	<b>-B</b>
<b>P<sub>t</sub></b> 140	<b>ü</b> 156	<b>,</b> 172	<b>&lt;</b> 188	<b>L</b> 204	<b>\</b> 220	<b>l</b> 236	<b>!</b> 252	<b>-C</b>
<b>À</b> 141	<b>É</b> 157	<b>-</b> 173	<b>=</b> 189	<b>M</b> 205	<b>]</b> 221	<b>m</b> 237	<b>}</b> 253	<b>-D</b>
<b>â</b> 142	<b>é</b> 158	<b>.</b> 174	<b>&gt;</b> 190	<b>N</b> 206	<b>^</b> 222	<b>n</b> 238	<b>~</b> 254	<b>-E</b>
<b>ç</b> 143	<b>¥</b> 159	<b>/</b> 175	<b>?</b> 191	<b>O</b> 207	<b>_</b> 223	<b>o</b> 239	<b>Ø</b> 255	<b>-F</b>




























# IBM ALL CHARACTER OVERLAY\*

	0-	1-	2-	3-	4-	5-	6-	7-
0		▶ 16						
-1	☺ 1	◀ 17						
-2	☺ 2	↕ 18						
-3		!! 19						
-4		¶ 20						
-5								
-6		— 22						
-7	● 7	↕ 23						
-8	◼ 8	↑ 24						
-9	○ 9	↓ 25						
-A	◼ 10	→ 26						
-B	♂ 11	← 27						
-C	♀ 12	└ 28						
-D	♪ 13	↔ 29						
-E	♪ 14	▲ 30						
-F	⚙ 15	▼ 31						△ 127

\* Only characters in unshaded areas are overlaid onto the active character set.

[illegible]

## IBM #2 ALL CHARACTER MULTILINGUAL CHARACTER SET\*

	0-	1-	2-	3-	4-	5-	6-	7-
0	<b>NUL</b> 0	 16	<b>SP</b> 32	<b>0</b> 48	<b>@</b> 64	<b>P</b> 80	<b>`</b> 96	<b>p</b> 112
-1	<b>•</b> 1	 17	<b>!</b> 33	<b>1</b> 49	<b>A</b> 65	<b>Q</b> 81	<b>a</b> 97	<b>q</b> 113
-2	<b>•</b> 2	 18	<b>"</b> 34	<b>2</b> 50	<b>B</b> 66	<b>R</b> 82	<b>b</b> 98	<b>r</b> 114
-3	 3	<b>!!</b> 19	<b>#</b> 35	<b>3</b> 51	<b>C</b> 67	<b>S</b> 83	<b>c</b> 99	<b>s</b> 115
-4	 4	 20	<b>\$</b> 36	<b>4</b> 52	<b>D</b> 68	<b>T</b> 84	<b>d</b> 100	<b>t</b> 116
-5	 5	<b>§</b> 21	<b>%</b> 37	<b>5</b> 53	<b>E</b> 69	<b>U</b> 85	<b>e</b> 101	<b>u</b> 117
-6	 6	<b>•</b> 22	<b>&amp;</b> 38	<b>6</b> 54	<b>F</b> 70	<b>V</b> 86	<b>f</b> 102	<b>v</b> 118
-7	 7	 23	<b>'</b> 39	<b>7</b> 55	<b>G</b> 71	<b>W</b> 87	<b>g</b> 103	<b>w</b> 119
-8	 8	 24	<b>(</b> 40	<b>8</b> 56	<b>H</b> 72	<b>X</b> 88	<b>h</b> 104	<b>x</b> 120
-9	 9	 25	<b>)</b> 41	<b>9</b> 57	<b>I</b> 73	<b>Y</b> 89	<b>i</b> 105	<b>y</b> 121
-A	 10	 26	<b>*</b> 42	<b>:</b> 58	<b>J</b> 74	<b>Z</b> 90	<b>j</b> 106	<b>z</b> 122
-B	 11	 27	<b>+</b> 43	<b>;</b> 59	<b>K</b> 75	<b>[</b> 91	<b>k</b> 107	<b>{</b> 123
-C	 12	 28	<b>,</b> 44	<b>&lt;</b> 60	<b>L</b> 76	<b>\</b> 92	<b>l</b> 108	<b>!</b> 124
-D	 13	 29	<b>-</b> 45	<b>=</b> 61	<b>M</b> 77	<b>]</b> 93	<b>m</b> 109	<b>}</b> 125
-E	 14	 30	<b>.</b> 46	<b>&gt;</b> 62	<b>N</b> 78	<b>^</b> 94	<b>n</b> 110	<b>~</b> 126
-F	 15	 31	<b>/</b> 47	<b>?</b> 63	<b>O</b> 79	<b>_</b> 95	<b>o</b> 111	 127

\* Also called the multilingual PC-8 character set.



8-	9-	A-	B-	C-	D-	E-	F-	
Ç 128	É 144	á 160	• 176	• 192	đ 208	Ó 224	- 240	0
ü 129	æ 145	í 161	• 177	• 193	Đ 209	ß 225	± 241	-1
é 130	Æ 146	ó 162	• 178	• 194	Ê 210	Ô 226	= 242	-2
â 131	ô 147	ú 163	• 179	• 195	Ë 211	Ò 227	¾ 243	-3
ä 132	ö 148	ñ 164	• 180	• 196	È 212	ō 228	¶ 244	-4
à 133	ò 149	Ñ 165	À 181	• 197	¹ 213	Õ 229	§ 245	-5
å 134	û 150	ª 166	Ã 182	ã 198	Í 214	µ 230	÷ 246	-6
ç 135	ù 151	º 167	Ä 183	Ä 199	Î 215	þ 231	² 247	-7
ê 136	ÿ 152	¿ 168	© 184	• 200	İ 216	þ 232	³ 248	-8
ë 137	Ö 153	® 169	• 185	• 201	• 217	Ú 233	⁴ 249	-9
è 138	Ü 154	ª 170	• 186	• 202	• 218	Û 234	⁵ 250	-A
ï 139	ø 155	½ 171	• 187	• 203	• 219	Ü 235	⁶ 251	-B
î 140	£ 156	¼ 172	• 188	• 204	• 220	Ý 236	⁷ 252	-C
ì 141	Ø 157	¡ 173	¢ 189	• 205	ı 221	Ý 237	⁸ 253	-D
Ä 142	× 158	« 174	¥ 190	• 206	İ 222	- 238	• 254	-E
Å 143	f 159	» 175	• 191	¤ 207	• 223	´ 239	SP 255	-F



---

# Appendix E— Barcodes

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This appendix explains how to use the printer to print barcodes.

Barcodes are printed in accordance with Automatic Identification Manufacturers (AIM), Material Handling Institute, Inc., the UPC Symbol Specification Manual, and the U.S. Postal Service. The barcodes supported are listed below:

Barcode	Description	Barcode	Description
Code 39	USD-3	UPC-E	*
Interleaved 2 of 5	USD-1	EAN-8	*
Codabar	USS CODABAR	EAN-13	*
UPC-A	*	PostNet	**

Detailed descriptions for commercial barcodes are available from Automatic Identification Manufacturers, Material Handling Institute Inc., 1326 Freeport Road, Pittsburgh, PA 15238, USA, (412) 963-8588. Additional information is contained in ***Reading Between the Lines, An Introduction to Barcode Technology***, by Craig K. Harmon and Russ Adams, published 1984 by Helmers Publishing, Inc., 174 Concord St., Peterborough, NH 03458.

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\* Specifications for UPC and EAN barcodes can be found in the ***UPC Symbol Specifications Manual***, available from the Uniform Code Council, Inc., P.O. Box 1244, Dayton, OH 45401, (513) 435-3870.

\*\* USPS PostNet Zip + 4 Delivery Point specification for PostNet can be found in Postal Service Specification DMM Sections 324.72 through 324.77.

## PRINTING BARCODES

To print barcode symbols, proceed as follows:

1. Send the printer a Barcode Format command.

This command specifies characteristics of the barcode symbol, for example, bar height and width. (If this step is not performed, the default parameters are used.)

For example, in BASIC send

```
LPRINT CHR$(1);"AzM";CHR$(0);CHR$(0);CHR$(1);  
LPRINT CHR$(1);CHR$(3);CHR$(1);CHR$(3);CHR$(1);
```

to set up parameters for Example 1 on Page E-21.

2. Send the printer the Start Barcode command.

This command tells the printer to print all subsequent data in the form of a barcode symbol.

Send

```
LPRINT CHR$(1);"AzL1";
```

to begin interpreting and printing barcode patterns.

3. Send the printer the barcode data.

The data is printed in the form of a barcode symbol.

For example, send

```
LPRINT "1988,1988";CHR$(13);  
LPRINT "123456789123456789";CHR$(13);
```

to print the patterns shown in Example 1.

4. Send the printer the End Barcode command.

This command tells the printer to print all subsequent data as characters, not barcode symbols.

Send

```
LPRINT CHR$(1); "AzLØ";
```

to return to text mode.

If you have problems printing barcodes, use the hex dump mode, a binary editor, and/or a BASIC utility to verify and debug your command string.

For best results, use the commands **SOH AzM** and **SOH AzL** to format and print barcodes. These commands are explained on the following pages. They are valid in any emulation mode.

*Note:* Zeroes contained within control commands, such as **ESC [Øt**, are written as Ø to differentiate the number zero from the capital letter "O."

For PostNet, make sure "Barcode Density" in the configuration menu is set to 100 dpi.

For information on how to send the data byte values used in barcode commands to the printer, refer to the section titled "Control Commands—An Introduction." That same section also provides a listing of the typographic conventions used with the barcode commands.

## BARCODE FORMAT COMMAND

The Barcode Format command specifies the characteristics of the barcode symbols to be printed.

It is not required that this command be sent. If it is not sent, the default parameter values are used. The default value for each parameter is specified in the parameter definitions shown on the following pages.

The Barcode Format command is shown below:

ASCII:	SOH	A	z	M	(P1)...(P8)
Control:	CTRL A	A	z	M	(P1)...(P8)
Decimal:	1	65	122	77	(P1)...(P8)
Hexadecimal:	01	41	7A	4D	(P1)...(P8)

## P1 THROUGH P8

The (P1) through (P8) bytes are the parameters of the Barcode Format command.

### P1: Barcode Symbology

This parameter specifies the type of barcode to print. The valid entries for P1 are:

- |    |                         |                             |
|----|-------------------------|-----------------------------|
| 0  | Interleaved 2 of 5      |                             |
| 1  | PostNet (graphics mode) |                             |
| 4  | Code 39 (default value) |                             |
| 5  | EAN - 8                 |                             |
| 6  | EAN - 13                |                             |
| 9  | Codabar a/a -           | Start and stop character: a |
| 10 | Codabar b/b -           | Start and stop character: b |
| 11 | Codabar c/c -           | Start and stop character: c |
| 12 | Codabar d/d -           | Start and stop character: d |
| 13 | UPC - A                 |                             |
| 14 | UPC - E                 |                             |
| 21 | PostNet (text mode)     |                             |

See Page E-18 for information on Start and Stop Characters.

*Note:* For best PostNet barcodes, prefer text mode (P1=21) to graphics mode (P1=1). Also for PostNet, P2 through P8 may be any value; they must be included in the command but are ignored by the printer.

## **P2: Barcode Height**

The height of the barcode is adjustable from 1/12 in. to 10 in. in 1/12 in. increments.

The valid entries for P2 are :

0 or 9	3/4 in. (default value).
n	n/12 in. The valid range of n is 1 to 120.

## **P3: Human Readable Line**

Characters represented in the barcode symbol may be printed below the symbol in a human readable line. The line is centered or, if too long, left justified below the symbol. It is printed in the print style in place prior to the receipt of the Start Barcode command.

*Note:* Enlarged text is not used for the human readable line. If the printer is set for enlarged text (5, 6, 7.5, 8.57, or 9.1 pitch), the human readable line is printed in the corresponding regular pitch (10, 12, 15, 17.14, or 18.2 pitch, respectively).

The valid entries for P3 are :

0	Do not print human readable line.
1	Print human readable line (default value).

*Note:* Parameters P4 through P8, discussed on the following pages, should be specified only by users familiar with barcode symbol descriptions. These parameters set the width of bars and spaces in the barcode symbol. Improper adjustment may make the symbols unreadable. The default values for these parameters produce barcodes of maximum density.

If you do adjust these parameters, they must be adjusted as a



group to ensure barcode symbol integrity.

For all UPC and EAN barcodes, we recommend these parameters be used without change. Adjusting them is likely to make the symbols unreadable.

All measurements shown are approximate. The actual sizes of printed elements and the readability of the resulting symbols are affected by many factors including ribbon wear, paper type, and head gap adjustment.

#### **P4: Narrow Bar Width**

This parameter specifies the width of the narrow bars in a barcode symbol. The valid entries for P4 are :

0 or 1	0.014 in. (default value)
2	0.027 in.
n	$0.014 + 0.0133 * (n-1)$ for $n \leftarrow 0$ .

#### **P5: Wide Bar Width**

This parameter specifies the width of the wide bars in a barcode symbol. The valid entries for P5 are:

1	0.014 in.
2	0.027 in.
0 or 3	0.040 in. (default value)
4	0.054 in.
n	$0.014 + 0.0133 * (n-1)$ for $n \leftarrow 0$ .

**P6: Narrow Space Width**

This parameter specifies the width of the narrow spaces in a barcode symbol. The valid entries for P6 are:

0 or 1	0.014 in. (default value)
2	0.027 in.
n	$0.014 + 0.0133 * (n-1)$ for $n \leftarrow 0$ .

**P7: Wide Space Width**

This parameter specifies the width of the wide spaces in a barcode symbol. The valid entries for P7 are:

1	0.014 in.
2	0.027 in.
0 or 3	0.040 in. (default value)
4	0.054 in.
n	$0.014 + 0.0133 * (n-1)$ for $n \leftarrow 0$ .

**P8: Intercharacter Gap**

This parameter allows you to adjust the gap between adjacent character representations in Code 39 and Codabar barcode symbols. The adjustment does not affect the other barcode styles. The valid entries for P8 are:

0 or 1	0.014 in. (default value)
2	0.027 in.
n	$0.014 + 0.0133 * (n-1)$ for $n \leftarrow 0$ .

## BARCODE FORMAT COMMAND EXAMPLE

The example below shows the barcode format command for a 3/4-in. high UPC-E barcode symbol with no human readable line. Default values are used for narrow and wide bar and space widths. The last parameter, intercharacter gap, does not affect UPC-E barcode symbols but must be sent with the other parameters. The command could be sent with the following program:

```
LPRINT CHR$(1);"AzM";CHR$(14);CHR$(0);CHR$(0);
LPRINT CHR$(1);CHR$(3);CHR$(1);CHR$(3);CHR$(1);
```

## START BARCODE COMMAND

All data sent to the printer following the Start Barcode command are printed as barcode symbols. The sole exception is the End Barcode command.

Either of two versions of the Start Barcode command can be used:

<i>ASCII:</i>	SOH	A	z	L	1
<i>Control:</i>	CTRL A	A	z	L	1
<i>Decimal:</i>	1	65	122	76	49
<i>Hexadecimal:</i>	01	41	7A	4C	31

or

<i>ASCII:</i>	SOH	A	z	L	2
<i>Control:</i>	CTRL A	A	z	L	2
<i>Decimal:</i>	1	65	122	76	50
<i>Hexadecimal:</i>	01	41	7A	4C	32

*Note:* The "1" and "2" in the Start Barcode command can be entered either as the character 1 or 2 (as shown) or as the decimal value 1 or 2.

- **SOH AzL1** enables barcode printing and honors line feeds. **SOH AzL1** is commonly used where vertical paper motion is controlled with form feeds.
- **SOH AzL2** enables barcode printing and discards line feeds. **SOH AzL2** is commonly used where vertical paper motion is controlled with line feeds only. In an application such as a report program generator, **SOH AzL2** preserves the RPG's expected positions of page endings and headers.

Both commands perform the same function, with the following difference: **SOH AzL2** calculates the number of lines required to print the barcode symbol, and human readable line, if any, then calculates the comparable number of line feeds at the line spacing in use prior to the start of barcode printing, and then eliminates that number of line feeds minus one from the text following the barcode. For example, if you specify a barcode symbol  $\frac{3}{4}$ -in. high, and if the text line spacing is set at 6 lines per in., a total of four lines plus a fraction of a line is required to print the barcode. The fraction of a line is rounded up, for a total of five lines. This number of line feeds, less one, is discarded; therefore, the next four line feeds after the barcode **SOH AzL2** are discarded.

## BARCODE DATA

This section provides information on entering barcode data, including:

- Valid characters for each type of barcode
- How to enter barcode data
- Adjusting the width of the quiet zone
- Spacing
- Controlling the placement of PostNet barcode symbols
- Error checking
- Number system characters

- Start characters, stop characters, and guard bars
- Summary of required barcode data

## VALID CHARACTERS

Each type of barcode has a defined set of valid characters. If an invalid character is detected for a particular code, the printer prints a pattern of all bars or a solid bar (invalid symbol) to flag that error.

The following shows the valid characters for each type of barcode:

### Code 39

0 1 2 3 4 5 6 7 8 9

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

- . <SPACE> \$ / + %

(Lowercase letters are printed in a barcode symbol identical to uppercase letters. The associated human readable line shows the correct case.)

### Interleaved 2 of 5\*

0 1 2 3 4 5 6 7 8 9

### Codabar (Styles 9, 10, 11, 12)\*

0 1 2 3 4 5 6 7 8 9

\- \$ : / . +

### UPC/EAN\*

0 1 2 3 4 5 6 7 8 9

### PostNet\*

0 1 2 3 4 5 6 7 8 9

---

\* Commas can be used to terminate these barcodes. Spaces and hyphens are ignored in printing PostNet barcodes.

## ENTERING BARCODE DATA

Barcode symbols are printed one line at a time. A line may contain one or many symbols.

To print a line containing a single barcode symbol, enter a sequence of characters terminated by a carriage return. For example:

1987<CR>

To print a line containing multiple symbols, enter multiple sequences of valid characters separated by commas, spaces, or horizontal tabs, depending on the barcode. Terminate each line with a carriage return. For example:

1985,1986,1987,1988<CR>

If a single symbol is too long to fit on a single line, the printer prints a pattern of all bars, an invalid symbol. For lines with multiple symbols, each symbol that fits in its entirety is printed correctly and the remainder are printed using a pattern of all bars or discarded, as space allows.

## QUIET ZONE

Except for PostNet barcodes, there is blank space preceding and following each barcode symbol called a quiet zone. The width of a quiet zone is 10 times the width of the narrow bar width, depending on the barcode. Narrow bars are at least 0.014 in. wide. Therefore, each quiet zone is at least 0.14 in. wide.

## SPACES

Space can be added between barcodes on the same line. Each space adds 0.10 in. for each space character inserted.

With UPC/EAN and Interleaved 2 of 5, spaces can be added just as you would between keyboard characters. For example,

012345678905<space>01234567895

Before adding spaces between PostNet and Codabar barcodes, however, you must use either a horizontal tab (ASCII decimal 9) or a comma (ASCII decimal 44) to terminate the preceding barcode. For example, to add one space between two Codabar barcodes, the barcode expression must be written either as

012345678905,<space>012345678905    or

012345678905<HT><space>012345678905

## POSTNET PLACEMENT ON AN ENVELOPE

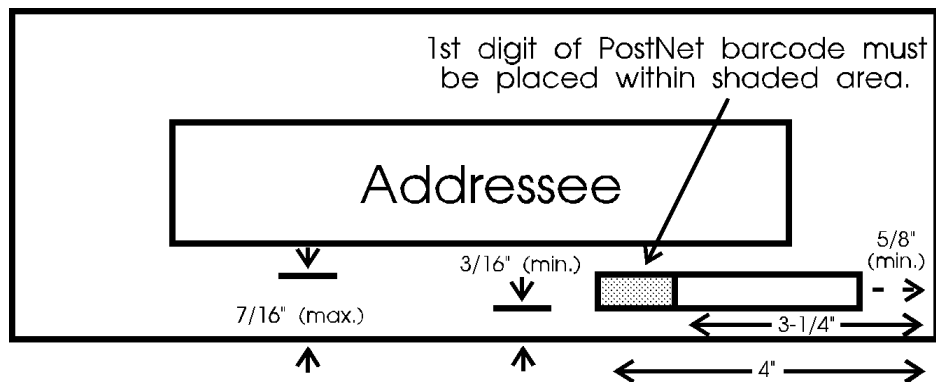
Placement of a USPS PostNet Zip + 4 Delivery Point barcode on an envelope is regulated by the U.S. Postal Service. PostNet barcode positioning on a standard-size business envelope, shown in the accompanying illustration, was correct at the time this manual was printed. The following BASIC program (Epson emulation) prints the PostNet barcode for "99212-1381" (with delivery point code of 10) in the position indicated in the illustration.

```
100      LPRINT CHR$(1);"AzM";CHR$(21);CHR$(0);
104      LPRINT CHR$(0);CHR$(0);CHR$(0);CHR$(0);
108      LPRINT CHR$(0);CHR$(0);

110      LPRINT:LPRINT:LPRINT:LPRINT
120      LPRINT:LPRINT:LPRINT:LPRINT
130      LPRINT:LPRINT:LPRINT:LPRINT
140      LPRINT:LPRINT:LPRINT:LPRINT
150      LPRINT:LPRINT:LPRINT
160      LPRINT CHR$(27);"I";CHR$(50);
170      LPRINT "Name"
180      LPRINT "Address"
190      LPRINT "City,State 99212-1381"
200      LPRINT CHR$(27);"I";CHR$(56);
210      LPRINT CHR$(1);"AzL1";
220      LPRINT "99212-1381 10"
230      LPRINT CHR$(1);"AzLØ";
```

*Note:* The printer imposes no limit on the number of barcode digits.





PostNet Placement on a  
Standard Business Envelope

AB0-AB

## CHECK DIGITS

The check digit is optional for Code 39, Interleaved 2 of 5, and Codabar; if desired, the check digit should be supplied as part of the data according to the specifications of the code you are using. EAN-8 barcodes do not use check digits. The check digit for UPC-E and PostNet barcodes are automatically calculated and appended by the printer. For UPC-A and EAN-13 barcodes, a check digit is required, but it is **not** automatically calculated and appended by the printer. The last character is used as the check digit. See the table below.

	Check Digit Required	Printer Calculates and Appends Check Digit	Check Digit Optional	No Check Digit
Code 39			•	
Interleaved 2 of 5			•	
Codabar			•	
UPC-A	•			
UPC-E		•		
EAN-8				•
EAN-13	•			
PostNet		•		

The check digit prints out along with all other barcode characters in the human readable line.

## NUMBER SYSTEM CHARACTERS AND COUNTRY FLAGS

The first character in UPC barcodes and the first two characters in EAN-13 barcodes are for symbol identification. The first digit is called a number system character. In EAN-13 barcodes, the second character is a country flag.

The number system character (and the country flag for EAN-13 barcodes) must be sent to the printer along with the other characters in the code. It is the first digit of the code.

## START CHARACTERS, STOP CHARACTERS, AND GUARD BARS

You do not need to supply start and stop characters, or guard bars (for UPC and EAN codes) with the barcode. They are automatically appended by the printer.

## SUMMARY OF REQUIRED BARCODE DATA

The table below summarizes the data the printer must receive for each barcode symbol. A "●" indicates required data. An asterisk (\*) indicates optional data. A blank space indicates the data are automatically calculated and appended, or are not applicable for that barcode style.

Barcode Style	Start Char.	No. System Char.	Country Flag Char.	No. of Significant Char.	Stop Char.	Check Digit	Total No. of Char.
Code 39				*		*	*
Interleaved 2 of 5 (see note)				*		*	*
Codabar Styles 9-12	●			*		*	*
UPC-A		●		10		●	12
UPC-E				10			10
EAN-8				8			8
EAN-13		●	●	10		●	13
PostNet				*		●	*

*Note:* For Interleaved 2 of 5 barcode symbols, if an even number of characters is not sent, the printer appends a leading zero.

## END BARCODE COMMAND

The End Barcode command terminates the printing of barcode symbols. The printer returns to printing characters in the font style in place prior to receipt of the Start Barcode command.

End Barcode command must be in the following form:

<i>ASCII:</i>	SOH	A	z	L	Ø
<i>Control:</i>	CTRL A	A	z	L	Ø
<i>Decimal:</i>	1	65	122	76	48
<i>Hexadecimal:</i>	01	41	7A	4C	30

*Note:* The zero in the Stop Barcode command can be entered either as the character Ø (zero, as shown) or as the decimal value zero.

## EXAMPLES

### EXAMPLE 1

This example shows a BASIC program to format and print three 3/4-in. high Interleaved 2 of 5 barcode symbols. The human readable line is on, and default values are used for bar and space widths. Two of the barcode symbols encode the characters "1988", and the third barcode symbol encodes the characters "123456789123456789".

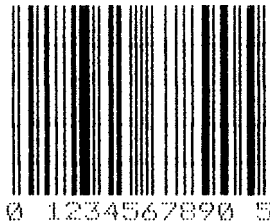
```
REM FORMAT INTERLEAVED 2 OF 5 BARCODE SYMBOLS
LPRINT CHR$(1);"AzM";CHR$(0);CHR$(0);CHR$(1);
LPRINT CHR$(1);CHR$(3);CHR$(1);CHR$(3);CHR$(1);
REM START BARCODE
LPRINT CHR$(1);"AzL1";
REM PRINT TWO BARCODE SYMBOLS ENCODING
REM CHARACTERS "1988"
REM ADVANCE PAPER, THEN PRINT
REM ONE BARCODE SYMBOL ENCODING CHARACTERS
REM "123456789123456789"
LPRINT "1988,1988";CHR$(13);
LPRINT "123456789123456789";CHR$(13);
REM END BARCODE
LPRINT CHR$(1);"AzLØ";
```



## EXAMPLE 2

This example shows a BASIC program to format and print one 1-in. high UPC-A barcode symbol. The human readable line is on, and default values are used for bar and space widths. The barcode symbol encodes the number system character "0", the characters "1234567890", and the check digit 5.

```
REM FORMAT UPC-A BARCODE SYMBOL
LPRINT CHR$(1);"AzM";CHR$(13);CHR$(12);CHR$(1);
LPRINT CHR$(1);CHR$(3);CHR$(1);CHR$(3);CHR$(1);
REM START BARCODE
LPRINT CHR$(1);"AzL1";
REM PRINT BARCODE SYMBOL ENCODING CHARACTERS
REM "1234567890"
REM NUMBER SYSTEM CHARACTER IS 0, CHECK DIGIT IS 5
LPRINT "012345678905";CHR$(13);
REM END BARCODE
LPRINT CHR$(1);"AzLØ";
```



## ALTERNATE COMMANDS

For best results, use the commands explained earlier in this appendix to format and print barcodes. To provide compatibility with other printers, the following alternate barcode commands are also supported. They are valid only when the printer is in Epson emulation mode.

- **ESC [3t** Start Barcode command.  
Performs the same function as **SOH AzL1**
- **ESC [4t** Start Barcode command.  
Performs the same function as **SOH AzL2**
- **ESC [(P1);...;(P8)}** Barcode Format command.  
Performs the same function as **SOH AzM(P1)...(P8)**
- **ESC [Øt** End Barcode command.  
Performs the same function as **SOH AzLØ**

*Note:* The procedure to format and print barcodes using these commands is the same as explained on the preceding pages.

The Barcode Format command must be in the form:

**ESC [(P1);(P2);(P3);(P4);(P5);(P6);(P7);(P8)}**

Adjacent semicolons preceding a parameter value indicate that the preceding parameters are to remain unchanged. For example, to set P4 to a value of "2" without changing other parameters, use:

**ESC [;;;(2)}**

The (P1) through (P8) bytes are the values of the parameters of the command. Valid entries for each parameter are shown in the table below:

Parameter	Options	Setting
P1: Barcode Type (See Note 1)	0	Interleaved 2 of 5
	1	PostNet (Graphics Mode)
	4	Code 39 (default)
	5	EAN - 8
	6	EAN - 13
	9	Codabar a/a
	10	Codabar b/b
	11	Codabar c/c
	12	Codabar d/d
	13	UPC - A
	14	UPC - E
	21	PostNet (Text Mode)
P2: Barcode Height	0	3/4 in. (default)
	n	n/12 in. (n = 1 to 120)
P3: Human Readable Line	0	Disable
	1	Enable (default)
P4: Narrow Bar Width	0 or 1	.014 in. (default)
	2	.027 in.
	n	.014 + .0133 * (n-1) in.*
P5: Wide Bar Width	1	.014 in.
	2	.027 in.
	0 or 3	.040 in. (default)
	4	.054 in.
	n	.014 + .0133 * (n-1) in.*
P6: Narrow Space Width	0 or 1	.014 in. (default)
	2	.027 in.
	n	.014 + .0133 * (n-1) in.*
P7: Wide Space Width	1	.014 in.
	2	.027 in.
	0 or 3	.040 in. (default)
	4	.054 in.
	n	.014 + .0133 * (n-1) in.*
P8: Intercharacter Gap (See Note 2)	0 or 1	.014 in. (default)
	2	.027 in.
	n	.014 + .0133 * (n-1) in.*

**Note:** 1. Codabar a/a, b/b, and so forth refer to start and stop characters.  
2. Intercharacter gap is adjustable only for Code 39 and Codabar barcode symbols.

---

\* For n ≠ 0.



## P4 THROUGH P8 INTEGRITY

The tables that follow specify how parameters P4, P5, P6, P7, and P8 must relate to each other if you must make parameter adjustments using the Barcode Format command.

These tables apply only to Code 39 and Interleaved 2 of 5. Codabar settings are sufficiently complex to require careful analysis of the Uniform Symbol Description (USD-4) for Codabar. For UPC and EAN bar codes, we recommend the parameters be used without adjustment. Adjusting the symbols is likely to make them unreadable.

Parameter Formula	Principle
$P5 > 2 * P4$ and $P5 \leq 3 * P4$	Wide bar is 2 to 3 times wider than narrow bar.
$P6 = P4$	Narrow space width equals narrow bar width.
$P7 = P5$	Wide space width equals wide bar width.
$P8 \geq P4$ and $P8 \leq (9 * P4) + 3$	Intercharacter gap is 1 to 9 times as wide as narrow bar width.

Parameter	Valid Comparative Settings					
P4 Narrow Bar	0	1	2	3	4	5
P5 Wide Bar	0,3	0,3	5,6	7-9	9-12	11-15
P6 Narrow Space	0,1	0,1	2	3	4	5
P7 Wide Space <sup>†</sup>	0,3	0,3	5,6	7-9	9-12	11-15
P8 Intercharacter Gap	0-9	0-9	2-18	3-27	4-36	5-45

---

<sup>†</sup> See formula above.



---

# Glossary

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**ASCENDERS.** That part of a character that rises above the waist line. Also, a term used for superscript characters.

**ASCII CHARACTERS.** ASCII is an acronym for American Standard Code for Information Interchange. ASCII characters are unique, 7-bit values that represent letters, numbers, spaces, and symbols. This coding scheme allows for standardization of data and control communication between devices.

**BASELINE.** The imaginary horizontal line on which a character or line of characters rests.

**BAUD.** The speed at which data flows between the printer and computer, measured in bits of information transmitted per second.

**BIT.** Bit is an acronym for binary digit, one of the two digits (0 and 1) used in binary notation. Usually, eight bits are used to make up one character, or data byte.

**BUFFER.** Two buffers are used. A print buffer consisting of temporary memory in which the printer holds incoming print jobs, and a dedicated line buffer which holds the next line of characters or graphics to be printed.

**CHARACTER DOWNLOADING.** Process of defining bit-image data used to print a character, and assigning it to a data byte value between 0 and 255. Download characters are stored in RAM (temporary memory).

**CHARACTER LIBRARY.** A defined group of printable characters stored in the printer.

**CHARACTER MAP.** An assignment of printable characters to some data byte values between 0 and 255.

**CHARACTER NUMBER MAP.** Each character in a character library is numbered. The character number map specifies which characters are currently selected for each data byte value between 0 and 255.

**CHARACTER OPTIONS.** Used to select the appearance of printed characters; selected using the configuration menu, accessed from the printer switch panel, or by sending control commands from the computer.

**CHARACTER SET.** A complete assignment of control codes and printable character codes for all byte values between 0 and 255. Typically, the character set is built from a character map and a control code map.

**CHARACTER SOURCE MAP.** Describes the location of the character library (ROM or RAM) currently selected for each data byte value between 0 and 255.

**CODE PAGE.** A predefined IBM character map.

**COMMUNICATION PARAMETERS.** The combination of settings for baud, parity, handshaking, data bits, and stop bits that specify the way data are transmitted between devices, enabling accurate data transmission. Set communication parameters in the configuration menu.

**CONTROL CODE.** A single byte of information that starts, stops, or modifies printer action.

**CONTROL CODE MAP.** A fixed assignment of control codes to some of the data byte values between 0 and 255.

**CONTROL COMMAND.** Two or more bytes of control information that cause the printer to perform specific functions.

**DATA BITS.** Defines the number of data bits in each byte transmitted. A setting of 7 data bits is used to send ASCII characters 0 through 127. A setting of 8 data bits is required for sending graphics data and data byte values between characters 128 through 255.

**DATA BYTE.** A string of 7 or 8 bits that represents one character.

**DATA BYTE ACTION MAP.** Describes whether a data byte value between 0 and 255 is currently defined as a control code or a printable character.

**DATA BYTE MAP.** A group of five maps in printer memory that describe the action the printer is currently set to perform when it receives a data byte. A complete data byte map consists of the data byte action map, the control code map, the character source map, the character library map, and the character number map.

**DECENDERS.** That part of a character that falls below the character's baseline. Also, a term used to describe a subscript character.

**DECIMAL.** The numbering system that uses the numerals 0 to 9.

**DEFAULT.** A value or setting that is used if no alternate setting is specified. Default settings are in effect when the printer is turned on or reset.

**DOWNLOAD.** To send data from the computer to the printer.

**DTR.** Data Terminal Ready (DTR) is a hardware handshaking protocol in which a receiving device controls data flow by changing the voltage level on a signal wire.

**ERASEABLE PROGRAMMABLE READ ONLY MEMORY (EPROM).** A specific type of ROM. The printer uses a 128K x 8 bit EPROM for storing the software that has been electronically programmed into this ROM device. A programmed EPROM is sometimes referred to as "firmware."

**FACTORY DEFAULT.** A default assigned at the factory.

**FORM.** The area of paper defined between top of form positions.

**FORM FEED.** A control key on the printer switch panel and a control code used to advance the paper to the top of the next form.

**FORMS OPTIONS.** Used to select the appearance of the printed form. Accessed from the printer switch panel or by sending control commands from the computer.

**HANDSHAKING.** The exchange of signals or characters between connected devices to control data flow and prevent data loss. See DTR and X-ON/X-OFF.

**HEXADECIMAL.** A numbering system that uses the numbers 0 to 9 and the letters A to F, so that each digit can represent sixteen different values.

**INTERFACE.** The physical and logical connection between two devices. See PARALLEL INTERFACE and SERIAL INTERFACE.

**LANGUAGE CHARACTER MAP.** Same as NATIONAL-USE CHARACTER MAP.

**LINE FEED.** A control key on the printer switch panel and a control code used to advance the paper one line.

**MAPPING.** Process of assigning characters and control codes to data byte values.

**NATIONAL-USE CHARACTER MAP.** Character maps specific to different countries can be selected using the configuration menu.

**NEAR LETTER QUALITY (NLQ).** A method of printing used to increase the quality of printed characters. This option is set using the configuration menu, accessed from the printer switch panel, or with a control command.

**ON LINE.** When the printer is on line, it is able to print data. The printer is placed on line or off line by pressing the **ON LINE** key located on the printer switch panel.

**PAGE.** The area of paper defined between horizontal perforations.

**PARALLEL INTERFACE.** Physical and logical connection between devices where data are transmitted an entire character at a time.

**PARITY.** The value of the parity bit in each character transmitted. Parity checking ensures accurate data transmission.

**PITCH.** A measure of the number of characters printed per horizontal inch of paper. Pitch can be set using the configuration menu or with control commands. (Also, in the DEC LA210 emulation, "vertical pitch" is a term that refers to the number of lines per in.)

**PLATEN.** The hard surface behind the paper that allows the printhead pins and ribbon to cause an impression on the paper.

**PRINTABLE CHARACTER.** A printable dot pattern: letters, numbers, punctuation marks, graphic shapes, and all other symbols that can be printed as a unit within a single cell.

**PRINTER EMULATION.** When a printer is set to respond to the commands of another brand of printer, it is said to emulate that printer. The printer can be set to emulate the Epson FX-100, IBM Proprinter XL, or DEC LA210.

**PRINthead.** One of three devices, each containing nine vertically aligned pins, that cause strike-on impressions on the paper.

**PRINthead GAP.** The distance between the printheads and the platen.

**PROTOCOL.** Same as HANDSHAKING.

**RANDOM ACCESS MEMORY (RAM).** This is the printer's memory which stores downloaded character and control data, and incoming print jobs. The printer contains a 32K x 8 bit volatile RAM. Volatile RAM loses its character and control data when printer power is turned off. [The microprocessor contains nonvolatile RAM (NVRAM) to retain configuration default settings during periods when the printer is off.]

**READ ONLY MEMORY (ROM).** The printer's permanent memory. For the 4100 printer, ROM is the same as ELECTRONICALLY PROGRAMMABLE READ ONLY MEMORY.

**SERIAL INTERFACE.** Physical and logical connection between devices where data are transmitted one bit at a time.

**STOP BITS.** The number of bits that define the end of (or space between) each serial interface byte.

**SUBSCRIPT.** Used to print characters slightly lower on a line than the baseline text around them. This option is set using the configuration menu or with a control command. Subscript characters are sometimes referred to as descenders.

**SUPERSCRIPT.** Used to print characters slightly higher on a line than the baseline text around them. This option is set using the configuration menu or with a control command. Superscript characters are sometimes referred to as ascenders.

**WAIST LINE.** The imaginary horizontal line that is the height of the top of a lower case "x" that divides tall and upper case characters. For example, "h," "d," "A," and the like have ascender attributes because part of these characters rise above the waist line, whereas "a," "c," "p," and the like do not.

**X-ON/X-OFF.** A software handshaking protocol in which a receiving device controls data flow using the content of data itself. X-OFF and X-ON are control characters which signal the sending device to stop or resume data transmission.



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